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ABSTRACT

This document, one of eight in a multi-cultural competency-based vocational/technical curricula series, is on fiberglass technician. This program covers 12 instructional areas: orientation, safety, introduction to fiberglass-reinforced plastics, hand lay-up, introduction to equipment operation, chopper operation, gel-coat equipment, finish and repair, mold-making, quality control, woodworking, and industrial relations. A duty-task index lists competencies in each instructional area that the student should be able to perform at the end of the program. For example, in the hand lay-up section, a student should be able to (1) identify and explain the use of lamination tools and materials, (2) prepare a mold, and (3) laminate the mold. In section 1, each instructional task area contains a list of performance objectives, evaluation criterion, performance guide, and a list of tasks to be covered. In section 2, the introduction and duty-task index is repeated in English, Spanish, and Laotian. Section 3 lists technical terms concerning fiberglass technology in English, Spanish, and Laotian. (CT)

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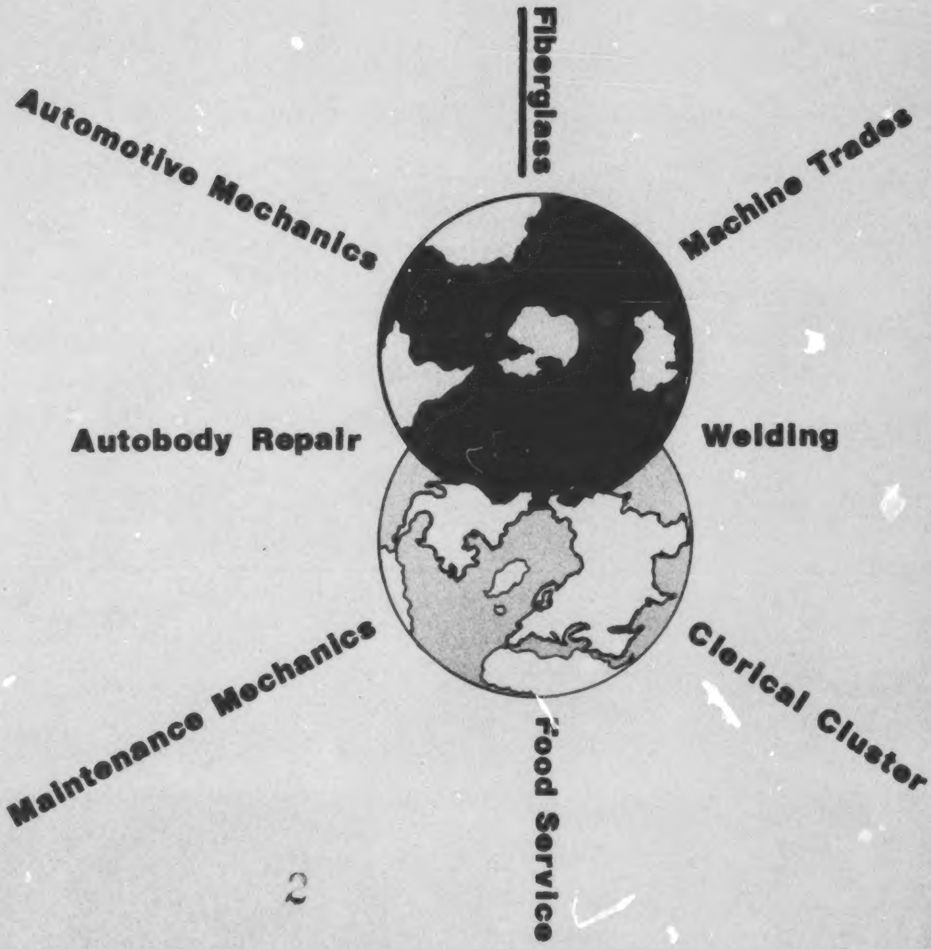
Fiberglass
Automotive Mechanics
Machine Trades
Autobody Repair
Welding
Maintenance Mechanics
Clerical Cluster
Food Service

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Research and
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June 1981

Career Development Center
Project Development and Management
School of Technical Careers
Southern Illinois University at Carbondale

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    FIBERGLASS TECHNICIAN

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    English
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    Laotian

IV. Technical Lexicon:
    English
    English/Spanish
    English/Laotian

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Product Abstract

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____ 04 Distributive Education
____ 07 Health Occupations Education
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____ 10 Industrial Art Education
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____ 17 Trade and Industrial Education
____ 22 Cooperative Education
____ Career Education
____ Other (Specify) ____

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____ 7-8
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X 11-12
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X Teacher (Pre-Service)
X Administrator (Pre-Service)
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FIBERGLASS TECHNICIAN series contains:

1. Competency-Based Curriculum in VESL.
2. Program Introduction and Outline in English; Laotian; and Spanish.
3. Lexicon of Technical Terms in VESL: English-Laotian; and English-Spanish versions.

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COMPETENCY-BASED CURRICULUM SERIES

FIBERGLASS TECHNICIAN

CAREER DEVELOPMENT CENTER
SCHOOL OF TECHNICAL CAREERS
SOUTHERN ILLINOIS UNIVERSITY
CARBONDALE, ILLINOIS

COMPETENCY-BASED VOCATIONAL/TECHNICAL CURRICULUM SERIES

FIBERGLASS TECHNICIAN

MASAKO T. SHIN, CURRICULUM SPECIALIST, STC, SIU-C

The preparation of this multicultural series was aided financially through funding agreements with the Illinois State Board of Education/Department of Adult, Vocational and Technical Education.

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ARDEN L. PRATT, DEAN
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LARRY HEPBURN, CENTER DIRECTOR

June 1981

OUR GOAL

TO ACHIEVE THE MAXIMUM IN THE MINIMUM TIME

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INTRODUCTION

Although the first synthetic material was developed in the mid-nineteenth century, plastics did not become a major engineering material until the early part of the 20th century. Celluloid, the first synthetic or plastic material, did not advance the molded-products industry, because it was not flexible and had limited application. In the 1850's, the Synthetic Molded Products Industry was limited to the production of checkers, combs, picture frames, display plaques, etc.

Today, what we most often call Engineering Plastics includes the acetals, nylons, phenolics, polycarbonates, and fluorocarbons. The growth of these 20th century plastics in industrial and commercial use surpasses most conventional materials such as metals, rubber, ceramics and paper. These 20th century plastics have superior design flexibility, strength-to-weight ratio, abrasion resistance, corrosion resistance, and dimensional stability. Their basic advantages are less cost for the manufacturer and better products for the consumer.

Hence, the Fiberglass Reinforced Plastics Industry, a member of the Engineering Plastics Family, has become one of the fastest growing manufacturing businesses in the nation. Many areas of industry are using fiberglass reinforced plastics (FRP) to promote new products, new designs, parts, and production methods. As a result, there is a rapidly growing demand for trained FRP production workers and technicians.

In response to that demand, the Career Development Center of the School of Technical Careers at Southern Illinois University in Carbondale has developed a comprehensive training program for fiberglass production workers and technicians. The training period for a fiberglass technician is thirty-two (32) weeks. However, the program has an open entry/open exit policy which allows the student to leave the program whenever he or she is "job-ready" and can find a job.

The Fiberglass Technician Program provides the student with an in-depth study of the use of fiberglass reinforced plastic (FRP) and its components to create a finished product. The Fiberglass Curriculum covers the following modules: Orientation, Safety, Introduction to FRP, Hand Lay-up, Introduction to Equipment Operation, Chopper Operation, Gel-coat Operation, Finish and Repair, Mold-Making, Quality Control, Woodworking, Industrial Relations and Related Education.

The Fiberglass Training Program and the Career Development Center Staff will provide the student and the industry with appropriate help in placement and follow-up study. The industrial areas which are possible job markets for our graduates are: automotive, agricultural, chemical processing, construction, marine, recreational, transportation and electrical.

FIBERGLASS: DUTY-TASK INDEX

I. ORIENTATION TO FIBERGLASS

1. Demonstrate a full understanding of the attendance policy, C.D.C. rules and regulations, the curriculum outline and evaluation.

II. SAFETY

1. Maintain good safety and health habits.

III. LEARN BASIC INFORMATION ABOUT FIBERGLASS REINFORCED PLASTICS, FRP

1. Demonstrate an understanding of background information about FRP materials.
2. Demonstrate an understanding of the background chemistry of polyester resins.
3. Demonstrate an understanding of reinforcements and additives used in FRP.
4. Demonstrate an understanding of FRP molding methods.

IV. HAND LAY-UP

1. Identify and explain the use of lamination tools and materials.
2. Prepare a mold.
3. Laminate the mold.

V. EQUIPMENT OPERATION

1. Understand systems safety requirements.
2. Understand the operating principles of plural component systems.

VI. CHOPPER OPERATION

1. Learn the operating procedures for the airless chopper equipment.
2. Operate the airless chopper equipment.
3. Learn the operating procedures for the air-atomized chopper equipment.

VI. CHOPPER OPERATION (cont.)

4. Operate the air-atomized chopper equipment.
5. Calibrate the chopper equipment.
6. Demonstrate production-level chopper operation competency.
7. Perform tool room duty.

VII. OPERATING THE GEL-COAT EQUIPMENT

1. Perform the airless gel-coat operation.
2. Perform the air atomized gel-coat operation.
3. Perform the equipment calibration.
4. Operate the gel-coat equipment at production level competency.
5. Serve as a tool room attendant.

VIII. FINISH & REPAIR

1. Identify repair materials and explain their use.
2. Identify repair tools and explain their use.
3. Restore the gloss.
4. Sand the gel-coat to remove surface imperfections.
5. Repair gel-coat defects which do not enter the laminate.
6. Repair a small hole which enters but does not penetrate through the laminate.
7. Repair fractures or holes which penetrate through the laminate.
8. Respray a small area with gel-coat.

IX. MOLD-MAKING

1. Understand the mold-making process.
2. Sand to produce a level surface.
3. Build a mold from an existing plug.
4. Perform the Mirro-Glaze process.

X. QUALITY CONTROL

1. Identify and explain the testing equipment of the incoming materials.
2. Perform the in-process and final inspection.

XI. WOODWORKING

1. Learn background information about hand tools.
2. Learn background information about working with wood.
3. Learn background information about fasteners and adhesives.
4. Operate a power drill.
5. Operate a portable power saw.
6. Operate a saber saw.
7. Operate a router.
8. Operate a power sander.
9. Operate a power grinder.
10. Operate a sanding machine.
11. Operate a bench saw.
12. Operate a radial arm saw.
13. Operate a band saw.
14. Operate a drill press.

XII. UNDERSTANDING INDUSTRIAL RELATIONS

1. Learn about management, supervision and labor.
2. Learn how to complete job applications.
3. Learn what to do at job interviews.

FIBERGLASS:

UNIT I - ORIENTATION

The Orientation Unit consists of classroom and laboratory activities designed to give the student an overview of the program and an understanding of the Center rules and regulations.

Tasks Covered:

1. Demonstrate a full understanding of the attendance policy, C.D.C. rules and regulations, the curriculum outline and evaluation.
    a. Attendance and Performance Policy
    b. C.D.C. Rules and Regulations
    c. Shop Safety Precautions and Housekeeping Rules
    d. Orientation Quiz - Open Book
    e. Student Achievement Form

DUTY: ORIENTATION TO FIBERGLASS

TASK: Demonstrate a full understanding of the attendance policy, C.D.C. rules and regulations, the curriculum outline and evaluation.

Performance Objectives:

Given a lecture presentation, reading materials, and a tour of the facilities, the student will complete the Open-book Orientation Quiz.

Evaluation Criterion:

The student will listen to the lecture and participate in the question/answer session.

The student will demonstrate an understanding of the orientation materials by completing and signing the Open-book Orientation Quiz with 100% accuracy.

Performance Guide:

1. Participate in lecture/discussion and question/answer session.
2. Read the handouts:
   (1) Attendance Policy
   (2) Rules and Regulations (Career Development Center, School of Technical Careers, S.I.U.)
   (3) Shop Safety Precautions and Housekeeping Rules
   (4) Student Achievement Form
   (5) Final Evaluation Report
3. Fill in the student attendance report.
4. Fill in the student achievement form.
5. Participate in the tour of the facilities.
6. Complete the Open-book Orientation Quiz.

CAREER DEVELOPMENT CENTER

SCHOOL OF TECHNICAL CAREERS

Attendance and Performance Policy

1. Excused Absence with Pay (E):

Each student is eligible for one excused absence with pay during each four-week training period. These days may accumulate but not exceed five (5) days.

These excused absences may not be accumulated for use in shortening a training program by not attending the last week or two of training.

(E)-time must be used in full-day increments. No (E)-time may be used before the third week of training.

2. Funeral (F):

Absences for attendance at funerals will be considered for deaths of immediate family members only: specifically, mother, father, sister, brother, children and spouse.

Funeral (F)-days may be granted for up to three days with pay and will not be calculated for absentee percentage purposes.

3. Court Appearance (C):

Jury duty or verified orders to appear in court will be honored in allowing student's absence. A student may use an (E)-day for this purpose.

Verified (C)-days will be without pay but will not be calculated for absentee percentage purposes.

4. Training Related Absence (T):

Public aid, unemployment, program agent, and Career Development Center matters may be excused time with pay provided "prior approval" is received from the class instructor and the counselor.

Approved (T)-time will not be calculated for absentee percentage purposes.

5. Unexcused Absence (U):

Any other absences are unexcused and without pay. (U)-time is considered excessive absenteeism.

Absence from training will be kept on an hourly rather than a daily basis. Any unexcused absence, tardy or an early checkout of five percent (5%) or more will be cause for consideration of "Termination for Absenteeism." (Example: 5% = 8 hours per 4-week period.)

6. Holiday Pay (H):

In order to receive holiday pay, the student must be in attendance the entire school day before and after the holiday or use an (E)-day for the absence.

7. Hours of Training:

The Career Development Center operates eight hours per day, five days per week unless otherwise indicated. Tardiness and/or early checkouts will be calculated as absence time (U).

8. Class Performance:

Students are expected to participate in assigned classroom activities. Willful nonparticipation time will be without pay.

On a weekly basis, students will be evaluated for their performance. In class where performance falls below the 70% level, a progress report will be prepared by the instructor indicating the performance deficit. The student and the instructor are to sign the report to indicate awareness of the poor performance.

If the student's performance continues below expectation as determined by the instructional staff, a meeting between the instructional staff, student and counselors will take place to identify methods to remedy the problem. If performance continues at an unacceptable level, the student will be terminated from the program.

All students will be evaluated monthly with a progress report completed, signed by the student and instructor, and filed in the student's permanent record. These permanent records will be utilized in judging progress, determining eligibility for BEOG and other benefits, and for providing recommendations to prospective employers.

9. Makeups:

All work missed, due to any absence, is to be completed as required by the instructors.

10. Inappropriate Behavior:

The instructor has the right to dismiss any student from the Career Development Center premises who exhibits behavior which is not conducive to learning or which may lead to possible injury to the student and others. The counselor and/or the director are to be notified of such incidents. Serious and/or repeated incidents are grounds for dismissal from the program.

Career Development Center
School of Technical Careers

Rules and Regulations

1. Students will park in the student parking area.
2. Dependent children are not permitted to come to school. Facilities are not provided for day care.
3. The center cannot be responsible for anyone's personal belongings.
4. The use of drugs or alcohol on Federal Wildlife Refuge property is strictly prohibited by law.
5. Students should not leave training areas without giving notification to their instructors. Failure to notify may result in loss of pay.
6. No solicitations are allowed on the center premises.
7. Students are not permitted in other training areas without first securing permission from the instructor in charge of that area.
8. All safety regulations must be strictly observed.
9. Lunch time is one half hour long (12:00 to 12:30). Students will return promptly to class.
10. Students are expected to conduct themselves in accordance with the center policies and regulations. Any disruptive behavior will result in disciplinary action.

FIBERGLASS: Shop Safety Precautions and Housekeeping Rules

1. Keep electrical closet doors closed.
2. Run the adjacent fan when spraying.
3. Always wear eye protection when operating spray equipment.
4. NO SMOKING, FOOD, OR DRINKS in classrooms or workshop.
5. Never leave acetone or catalyst in unmarked or open containers.
6. Place all "hot spots" outside and cover with water.
7. Clean up all waste, rags, over-spray and trimmings as you work.
8. Remove all waste from the shop at the end of the day.
9. Move all catalyst and acetone cans to the chemical shed at the end of the day.
10. Avoid getting resin on the concrete floor or table tops.
11. Do not stand between operating spray equipment and exhaust fans.
12. Take special care to avoid damaging pressurized lines and glass tubes.
13. Never attempt to repair a pressurized system: Bleed all pressure first.
14. When a gun is removed for service, boom hoses must hang over a large container of water.
15. Rinse brushes and rollers immediately after each use.
16. At the end of the day, acetone rinse-tanks will be emptied and refilled.
17. Stay in your own area at all times; do not go into another area where classes are being conducted.
18. Clean up after yourself as you leave: This makes clean-up easier at the end of the day.

19. Do not take tools or anything out of any other area except the one you are working in.

20. No coffee breaks between classes.

21. No person is allowed in the office area except for business.

22. Make out your attendance card daily.

FIBERGLASS: Orientation Quiz - Open-book

Name: ______________________________ Date: ______________

1. What is an "E" day?

2. How often is an "E" day earned?

3. Funeral ("F") days will be granted for up to _______ days with pay.

4. Court Appearance ("C") days will be (with or without) pay if no "E" days are available.

5. Under what conditions can Training Related ("T") time be granted?

   ____

6. Unexcused ("U") time will be kept on (an hourly or a daily) basis.

7. Accumulated "U" time of _____% or more will be a cause for consideration of termination from the program.

8. What requirements must be met to receive holiday pay?

   ____

9. Student's pay may be withheld for time in attendance in case of ____.

10. Student performance evaluation scores must be kept above the _________% level in order to continue training.

11. (T) (F) Students may be sent home or eventually terminated for disruptive or unsafe behavior.

12. Are children permitted to visit the training facility?

    ____

13. Can the center be held responsible for anyone's personal belongings? ____

14. Is the use of drugs or alcohol allowed on the premises?

    ____

15. What must a student do if leaving the training area before the scheduled time?

____

16. Are solicitations allowed on the center premises? ______

17. What must a student do before entering another training area?

____

18. How often must the Student Attendance Report be filled out?

____

This signature certifies that I understand the above material.

____
Student Signature

FIBERGLASS: Student Achievement Form

Name:________________________________ Date:____________________

Date Enrolled:________________________

Date Completed:_______________________

Final Evaluation Score:______________

Modules	Course Hours	Date Entered	Date Completed	Evaluation
Orientation	20			
Safety	10			
Introduction to FRP	20			
Hand Lay-up	30			
Equipment Operation	10			
Chopper Operation	140			
Gel-coat Operation	140			
Finish & Repair	40			
Mold-Making	20			
Quality Control	10			
Woodworking	30			
Industrial Relation	10			
Related Education	160			
Total Hours in Training	640			

Instructor's Comments:

FIBERGLASS:

UNIT II - SAFETY

The Safety Unit consists of classroom activities designed to introduce the student to general shop safety, special problems of FRP materials, first aid, fire safety, and the chemicals used in the FRP industry.

Tasks Covered:

1. Maintain good safety and health habits.
    a. Safety Study Sheet #1 - General Safety
    b. Safety Study Sheet #2 - Health, Fire and Fire Protection
    c. Safety Study Sheet #3 - Tools
    d. Safety Study Sheet #4 - Safety in the FRP Shop
    e. Safety Test

DUTY: SAFETY

TASK: Maintain good safety and health habits.

Performance Objective:

The student will demonstrate knowledge and practice of the safety rules in the following areas:

Study Sheet #1: General safety.
Study Sheet #2: Health, fire, and fire protection.
Study Sheet #3: Tools.
Study Sheet #4: Safety in the FRP shop.

Evaluation Criterion:

The student will complete Study Sheets #1 - #4 with 100% accuracy using Rules for Safety and Health as reference.

The student will complete FIBERGLASS: Safety Test with 100% accuracy without any reference materials.

Performance Guide:

1. Study and discuss the pertinent topics from Rules for Safety and Health.
2. Complete Study Sheets #1 - #4 using reference materials.
3. Correct any mistakes on the Study Sheets #1 - #4.
4. Complete the FIBERGLASS: Safety Test and pass with 100% accuracy without reference materials.

FIBERGLASS: Safety Study Sheet #1 - General Safety

Name: ______________________________ Date: ______________

1. Explain in your own words the importance and need for safety rules:

   ____

   ____

2. What safety rule was considered most important by the study conducted in the industrial plant? ______________

   ____

3. List three other safety rules you consider important:

   (1) ____

   (2) ____

   (3) ____

4. What kinds of articles of clothing should not be worn around the machinery? Give at least 3 examples and explain the possible danger or hazard:

   (1) ____

   (2) ____

   (3) ____

5. Protective equipment for the eyes includes ____________ and ______________. These must be worn when there is a chance of being exposed to ____________________ or ____________________.

6. Head protection includes: ______________ and ____________.

7. Describe one type of head protection; when and why it is used.

   ____

   ____

8. When are the face and body shields worn? ________________
____

9. To the craftman, what are "Mickey Mouse Ears"? When are they used?
____
____

10. Explain why and when the following are used:

Leather and canvas gloves: ______________________

Plastic gloves: ______________________

Asbestos gloves: ______________________

11. When and where are the safety shoes needed? ____________
____

12. In the final analysis, "SAFETY" means: ________________
____
____

FIBERGLASS: Safety Study Sheet #2 - Health, Fire, and Fire Protection

Name: ______________________________ Date: ______________

1. According to Rules for Safety and Health, what is the most important health rule?

____

2. Why would neglect of the above rule become a factor in an accident?

____

3. What can be done to prevent the hazards associated with air-borne contaminants? ______________________________

____

4. Containers for chemicals should be labeled. What kinds of information should be included on the label?

(1) ____

(2) ____

(3) ____

5. What precautionary measures are necessary when in contact with welding sparks and light rays?

____

6. List 2 good housekeeping rules: Explain why.

(1) ____

(2) ____

7. A major fire is disaster wherever it occurs. What are the three factors (prerequisites) necessary for a fire to start?

(1) ____

(2) ____

(3) ____

8. List three of the possible causes of fire: Explain the safety precaution against each.

   (1) ____________________: ________________________________

   (2) ____________________: ________________________________

   (3) ____________________: ________________________________

9. For fire prevention, constant care and vigilance must be exercised at all times. In addition, it is your responsibility to know:

   (1) ____

   (2) ____

   (3) ____

10. Explain the use of one type of fire extinguisher: _______

    ____

    ____

    ____

FIBERGLASS: Safety Study Sheet #3 - Tools

Name: ______________________________ Date: ____________

1. Accidents with hand tools usually result from four basic causes. List any two.

   (1) ____

   (2) ____

2. Why should you check the condition of a tool before using it?

   ____

3. List two hazards associated with using a wrong tool: a wrench for example.

   (1) ____

   (2) ____

4. What is the correct method for using adjustable wrenches?

   ____

5. What is the primary reason for using a tool kit or tool belt?

   ____

6. Use a hammer of the correct type, weight, and size for a particular job. Explain when and how the following hammers are used.

   Ripping claw hammer: ______________________________

   Curve claw hammer: ______________________________

   Sledge or maul hammer: ______________________________

7. Why is it important to keep cutting edge of an axe, for example, sharp?

   ____

8. Of all hand tools, a chisel is perhaps the greatest cause of accidents. List three precautionary measures to be taken when working with one.

   (1) ______________________________

   (2) ______________________________

   (3) ______________________________

9. Before exerting your full force, what measure should be taken when using a pry bar?

   ____

   ____

10. Saws that are sharp and free of rust are less likely to bind or jump. List two things that can be done to keep saws in excellent condition.

   (1) ______________________________

   (2) ______________________________

11. Pliers are often used in place of other tools such as:

   (1) ______________________________

   (2) ______________________________

FIBERGLASS: Safety Study Sheet #4 - Safety in the FRP Shop

Name: ______________________________ Date: ____________

1. Why is polyester a health hazard?

   ____

2. Why is polyester a fire hazard? ______________________

3. The three prerequisites for any fire:

   (1) ____________ (2) ____________ (3) ____________

4. According to Cook, polyesters are sources of fuel when they are in the following states:

   (1) ____________ (2) ____________ (3) ____________

5. Which of the three states of the polyesters is potentially the most dangerous? ______________________________

6. What can be done to minimize the health and fire hazard of polyesters when they are in the form of vapors and dust?

   ____

7. How are polyester vapors created?

   ____

8. Why do polyester vapors collect in low spots?

   ____

9. Why shouldn't air filled with vapor and dust be circulated?

   ____

10. Apart from polyesters, list six other sources of fuel which Cook cites as present in the FRP shop:

    (1) ____________ (2) ____________ (3) ____________

    (4) ____________ (5) ____________ (6) ____________

11. Where can you find information about the regulation for discharging foreign materials into the air?

____

12. Uncatalyzed polyesters should be stored in ____________

____

13. Uncatalyzed polyesters should not be stored in ________ or where ____________________ is present.

14. As soon as possible, clean up all __________________ or __________________ of uncatalyzed polyester.

FIBERGLASS: Safety Test

Name: ______________________________ Date: ____________

Write "T" if the statement about safety is true or accurate:
Write "F" if the statement about safety is false.

1. ____ Comply with all plant safety rules and signs.

2. ____ Correct unsafe conditions if you can; if not report them whenever time permits.

3. ____ When lifting a heavy object, bend your back.

4. ____ Use any available tool for the job.

5. ____ Use prescribed protective equipment.

6. ____ You may use, adjust, and repair equipment if you think you know how.

7. ____ Gloves should be worn when working around machinery.

8. ____ Workers with long hair should wear a cap or hood to protect their hair.

9. ____ Clothing can be hazardous if worn, torn, loose or hanging.

10. ____ Safety glasses offer more protection than safety goggles.

11. ____ Mickey Mouse Ears refers to a type of lightweight bump cap.

12. ____ The jaws of an adjustable wrench should be kept sharp to ensure a secure bite or fit.

13. ____ The prerequisites of any fire are heat, oxygen and ignition source.

14. ____ Of all hand tools, the hammer is the greatest cause of accidents.

15. ____ The most important health rule is to eat right and get plenty of rest.

16. ____ When using a sledge hammer, always look behind you before beginning the back stroke.

17. ____ A curve claw hammer is used for prying woodwork apart.

18. ____ Saws that are sharp and free of rust are less likely to bind or jump.

19. ____ Never use compressed air to clean clothing.

20. ____ It is your responsibility to know how and where to turn in a fire alarm, where the fire extinguishers are kept, and what types of fires they are used for.

FIBERGLASS:

UNIT III - INTRODUCTION TO FIBERGLASS REINFORCED PLASTICS, FRP

The Introduction to FRP Unit consists of classroom activities designed to give the student an introduction to basic polyester chemistry and a survey of fiberglass production methods and materials.

Tasks Covered:

1. Demonstrate an understanding of background information about FRP materials.
    a. Introduction to FRP Test #1.
2. Demonstrate an understanding of the background chemistry of polyester resins.
    a. Introduction to FRP Test #2.
3. Demonstrate an understanding of reinforcements and additives used in FRP.
    a. Introduction to FRP Test #3.
4. Demonstrate an understanding of FRP molding methods.
    a. Introduction to FRP Test #4.

DUTY: LEARN BASIC INFORMATION ABOUT FIBERGLASS REINFORCED PLASTICS, FRP

TASK: Demonstrate an understanding of background information about FRP materials.

Performance Objectives:

Given a lecture presentation and reading assignments, the student will show an understanding of background information about FRP materials.

Evaluation Criterion:

The student will demonstrate knowledge of background information about FRP materials by completing the Introduction to FRP Test #1 with 70% accuracy without any reference materials.

Performance Guide:

1. Complete a reading assignment: Owens/Corning, FRP: Section I.
2. Take notes on lecture presentation.
3. Complete Introductions to FRP Test #1.

FIBERGLASS: Introduction to FRP - Test #1

Name: ______________________________ Date: ________________

1. FRP stands for ____.

2. GRP stands for ____.

3. What are the two basic components of FRP?

_________________________ _________________________

4-9. Match the following properties with the component which provides them: R for resin system, G for glass reinforcement.

4. ______ Heat resistance
5. ______ Electrical properties
6. ______ Chemical resistance
7. ______ Color
8. ______ Dimensional stability
9. ______ Strength

10. What are the two classes of plastic?

_________________________ _________________________

11. Which of these can be melted and reshaped?

____

12. Which of these require the addition of a catalyst?

____

13. List four forms of glass reinforcement.

_________________________ _________________________

_________________________ _________________________

14. In order to make the glass compatible with the resin system, a _______________ is added.

15-20. List the six ingredients of polyester resin.

15. ______________________ 16. ______________________

17. ______________________ 18. ______________________

19. ______________________ 20. ______________________

DUTY: LEARN BASIC INFORMATION ABOUT FIBERGLASS REINFORCED PLASTICS, FRP

TASK: Demonstrate an understanding of the background chemistry of polyester resins.

Performance Objectives:

Given a lecture presentation and reading assignments, the student will demonstrate an understanding of the background chemistry of polyester resins.

Evaluation Criterion:

The student will demonstrate knowledge of the background chemistry of polyester resins by completing Introduction to FRP Test #2 with 70% accuracy without any reference materials.

Performance Guide:

1. Complete reading assignment: Owens/Corning, FRP, pp. 11-15; Cook's Application Manual, pp. 1-6.
2. Take notes on lecture presentation.
3. Complete Introduction to FRP Test #2.

FIBERGLASS: Introduction to FRP Test #2

Name: ______________________________ Date: __________________

1. A general purpose resin is a name for ______________ acid.

2. Most gel-coats are made from _______________________ resin.

3. ________________ is an alcohol used to produce a chemical resistant resin and tooling gel-coat.

4. ________________ is a reactive acid used in all polyester resins.

5. ________________ is used to thin the base resin and eventually combine with it.

6. A curing system consists of an _________________ and a _________________.

7. ________________ are added to control free radicals and extend the shelf-life of the resin.

8. ________________ are added to speed up the action of the catalyst.

9. ________________ and _______________ may be used rather than a chemical accelerator.

10. Accelerators may also be called ________________________.

11. The most common curing system used in the fiberglass industry is ____________________ + ________________________.

12. BPO + DEA yields a _____________ gel and a ___________ cure.

13. MEKP + Cobalt yields a __________ gel and a ___________ cure.

14. The curing system used with "Bondo" is ________________ + ________________.

15. ________________ catalyst is never used in elevated temperature applications.

16. ________________ catalyst is supplied in liquid form.

17. ________________ catalyst is supplied in paste form.

18. _______________ may be added to speed up the cure time of MEKP + Cobalt.

19-21. Define the folowing:

19. Shelf-life: ____________________________________

20. Trim-time: ____________________________________

21. Pot-life: ____________________________________

22-25. List the four factors that determine the choice of curing system.

22. ____

23. ____

24. ____

25. ____

DUTY: LEARN BASIC INFORMATION ABOUT FIBERGLASS REINFORCED PLASTICS, FRP

TASK: Demonstrate an understanding of reinforcements and additives used in FRP.

Performance Objectives:

Given a lecture presentation and reading assignments, the student will learn basic information concerning reinforcements and additives used in the production of fiberglass products.

Evaluation Criterion:

The student will demonstrate a knowledge of reinforcements and additives by completing Introduction to FRP Test #3 with 70% accuracy without any reference materials.

Performance Guide:

1. Complete reading assignment: Owens/Corning, FRP, pp. 6-10.
2. Take notes on lecture presentation.
3. Complete Introduction to FRP Test #3.

FIBERGLASS: Introduction to FRP Test #3

Name: ______________________________ Date: ________________

1-3. Match the following:

_____ uni-directional

_____ bi-directional

_____ multi-directional

A. woven fabric - 75% loading

B. chopped mat - 10-50% loading

C. continuous roving - 80% loading

4. The strength of the fiberglass laminate will (increase or decrease) proportionally as the percentage of glass is increased.

5-12. Match the following materials with their characteristics:

_____ continuous roving

_____ woven roving

_____ woven fabric

_____ surfacing mat

_____ chopped mat

_____ combination mat

_____ chopped fibers

_____ milled fibers

A. 1/8" to 2" in length

B. untwisted strands wound into a cylindrical package

C. 3/4 oz. to 4 1/2 oz. per sq. ft. weight

D. 1/32" to 1/8" length

E. 2 1/2 oz. to 40 oz. per sq. yard weight

F. one ply of woven roving bonded to chopped mat

G. used to block fiber pattern

H. a heavy fabric made from continuous roving

13. ________________ gives the resin a variable viscosity.

14. ________________ is added when a product must withstand an extended exposure to the sunlight.

15. ________________ fibers are the only reinforcement which can provide the thermal and electrical conductivity.

16. ________________ fibers provide a lighter weight and a higher strength while maintaining thermal and electrical insulation.

FIBERGLASS: Introduction to FRP Test #3 - page 2

17-20. Match the following polyester types with their typical use.

_____	general purpose polyester	A. fume stacks
_____	light stable polyester	B. glazing, skylighting
_____	chemical resistant polyester	C. tooling
_____	high heat distortion polyester	D. boats, furniture

DUTY: LEARN BASIC INFORMATION ABOUT FIBERGLASS REINFORCED PLASTICS, FRP

TASK: Demonstrate an understanding of FRP molding methods.

Performance Objectives:

Given a lecture presentation and reading assignments, the student will learn basic information about various fiberglass molding methods.

Evaluation Criterion:

The student will demonstrate knowledge of the above information by completing the Introduction to FRP Test #4 with at least 70% accuracy without any reference materials.

Performance Guide:

1. Complete assigned readings: Owens/Corning, FRP, Section III.
2. Take notes on lecture presentation.
3. Complete the Introduction to FRP Test #4.

FIBERGLASS: Introduction to FRP Test #4

Name:______________________________ Date:________________

Match the following molding methods with its description and the diagram.

____ ____: Hand Lay-up

____ ____: Compression Molding

____ ____: Cold Press Molding

____ ____: Filament winding

____ ____: Continuous Laminating

____ ____: Encapsulation

____ ____: Spray-up

____ ____: Injection molding

____ ____: Comoforming

____ ____: Continuous Pultrusion

____ ____: Centrifugal Casting

Descriptions:

A. A process resulting in a high degree of fiber orientation and high glass loading to provide extremely high tensile strengths in the manufacture of hollow, generally cylindrical products such as chemical and fuel storage tanks and pipe, pressure vessels, and rocket motor cases.

B. A simple method for the embedment of electronic or electrical parts (such as coils, transformers, connectors) in a protective FRP capsule.

C. A low to medium volume, open mold method similar to hand lay-up in its suitability for making boats, tanks, tub/shower units, and other simple medium to large size shapes such as truck roofs, vent hoods, and commercial refrigeration display cases.

D. A continuous process for the production of sheet form output such as glazing panels, corrugated or flat construction panels, and electrical insulation material.

E. A continuous process for the manufacture of products having a constant cross section, such as rod stock, structural shapes, beams, channels, pipe, tubing, fishing rods.

F. A process for the production of cylindrical hollow shapes: water tanks, pipe, tubing, and containers.

Descriptions (cont.)

G. A special process which combines vacuum-formed thermoplastic shapes with cold molded Fiberglass-Reinforced Plastic laminates to produce parts with excellent surface appearance, weatherability, and strength.

H. A low to medium volume contact mold method suitable for making boats, tanks, housings and building panels for prototypes and for other large parts requiring high strength.

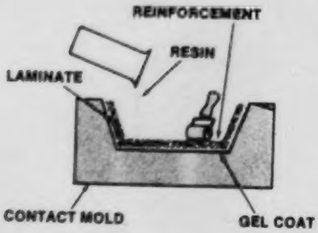
I. The process is an economical press molding method for manufacturing intermediate volumes of products (200 to 8,000) using low pressure, room temperature cure and inexpensive molds.

J. A high volume, high pressure method suitable for molding complex, high strength Fiberglas-Reinforced Plastic parts. Fairly large parts can be molded with excellent surface finish. Thermosetting resins are normally used.

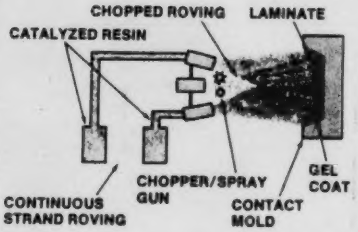
K. Thermoset molding compounds may be injection molded when the injection screw or plunger and chamber of the molding machine are held at low temperature with the mold temperature elevated (300°F-325°F) rather than cooled.

Diagrams:

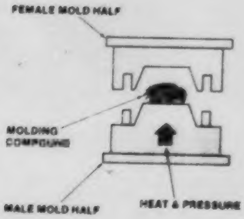
(1)


REINFORCEMENT
RESIN
LAMINATE
CONTACT MOLD
GEL COAT

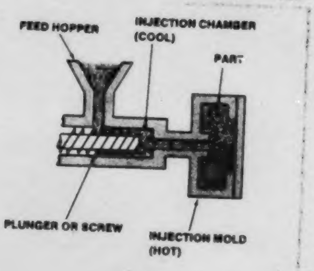
(2)


CHOPPED ROVING
LAMINATE
CATALYZED RESIN
CHOPPER/SPRAY GUN
GEL COAT
CONTINUOUS STRAND ROVING
CONTACT MOLD

(3)


FEMALE MOLD HALF
MOLDING COMPOUND
MALE MOLD HALF
HEAT & PRESSURE

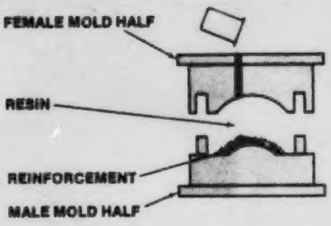
(4)


FEED HOPPER
INJECTION CHAMBER (COOL)
PART
PLUNGER OR SCREW
INJECTION MOLD (HOT)

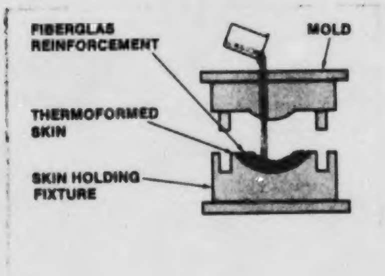
FIBERGLASS: Introduction to FRP Test #4 - page 3

Diagrams (cont.):

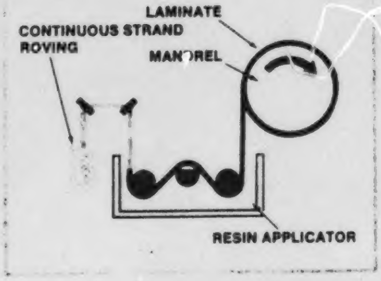
(5)


FEMALE MOLD HALF
RESIN
REINFORCEMENT
MALE MOLD HALF

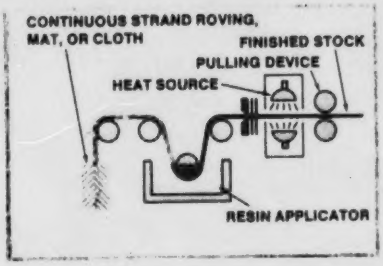
(6)


FIBERGLAS REINFORCEMENT
MOLD
THERMOFORMED SKIN
SKIN HOLDING FIXTURE

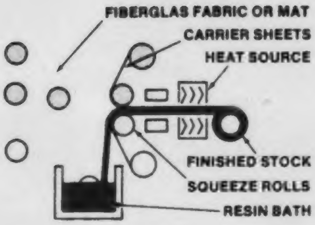
(7)


LAMINATE
CONTINUOUS STRAND ROVING
MANDREL
RESIN APPLICATOR

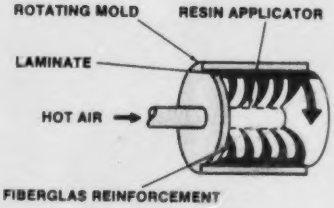
(8)


CONTINUOUS STRAND ROVING, MAT, OR CLOTH
FINISHED STOCK
PULLING DEVICE
HEAT SOURCE
RESIN APPLICATOR

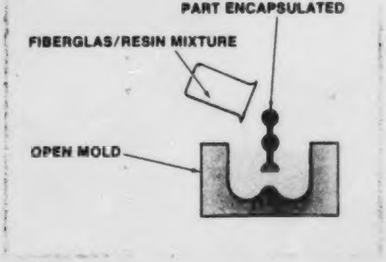
(9)


FIBERGLAS FABRIC OR MAT
CARRIER SHEETS
HEAT SOURCE
FINISHED STOCK
SQUEEZE ROLLS
RESIN BATH

(10)


ROTATING MOLD
RESIN APPLICATOR
LAMINATE
HOT AIR
FIBERGLAS REINFORCEMENT

(11)


PART ENCAPSULATED
FIBERGLAS/RESIN MIXTURE
OPEN MOLD

FIBERGLASS:

UNIT IV - HAND LAY-UP

The Hand Lay-up Unit consists of classroom and laboratory activities designed to teach the student lamination tools, materials and procedures.

Tasks Covered:

1. Identify and explain the use of lamination tools and materials.
2. Prepare a mold.
3. Laminate the mold.

DUTY: HAND LAY-UP

TASK: Identify and explain the use of lamination tools and materials.

Performance Objective:

Given a lecture presentation, a reading assignment, and the following lamination tools and materials, the student will identify and explain the use of each tool and material: 3/4 oz. mat, 1-1/2 oz. mat, fiberglass cloth, woven roving, resin, catalyst, acetone, roller, brush, and trim knife.

Evaluation Criterion:

The student will correctly identify and explain the use of each of the above materials and tools without reference materials.

Performance Guide:

1. Listen to lecture presentation.
2. Complete reading assignment: Cook's Manual, pp. 40-41.
3. Inspect tools and material samples.
4. Identify and explain the use of each of the tools and material samples.

DUTY: HAND LAY-UP

TASK: Prepare a mold.

Performance Objective:

Given a FRP mold, wax, tape, cheese cloth, cloth, soap and water, the student will prep a mold.

Evaluation Criterion:

The student will prep a mold following the procedure listed below. The tape will be neatly applied, the wax will be consistently applied to the entire surface and buffed to a gloss.

Performance Guide:

1. Select the tools and materials listed above.
2. Clean the mold with soapy water; rinse and wipe dry.
3. Tape the edges of the mold.
4. Apply the wax with circular motion.
5. Hand buff immediately with clean cheese cloth.

DUTY: HAND LAY-UP

TASK: Laminate the mold.

Performance Objective:

Given a prepped FRP mold, reinforcing mat, scissors, resin, catalyst, acetone, roller, brush and a list of the types and sequence of mat to use, the student will produce a laminate.

Evaluation Criterion:

The student will produce a laminate containing the types of mats in the orders specified. Each layer will be wet-trimmed. There will be no lamination defects.

Performance Guide:

1. Select the tools and materials listed above.
2. Tailor the mat to fit the mold.
3. Brush the mold with catalyzed resin.
4. Apply the first layer of reinforcing mat.
5. Roll out all air.
6. Allow to gel.
7. Wet-trim the laminate.
8. Clean up the work area and return all tools and unused materials.

FIBERGLASS:

UNIT V - INTRODUCTION TO EQUIPMENT OPERATION

This unit consists of classroom activities designed to give the student an introduction to the various types of production equipment.

Tasks Covered:

1. Understanding systems safety requirements.
    a. Polyester Systems Safety Quiz - Open-book
2. Understanding the operating principles of plural component systems.
    a. Plural Component Spray Systems Quiz - Open-book
    b. Equipment Operations Test #1

DUTY: EQUIPMENT OPERATION

TASK: Understanding systems safety requirements.

Performance Objectives:

Given a lecture presentation and reading assignment, the student will demonstrate an understanding of polyester systems safety requirements.

Evaluation Criterion:

The student will complete the open-book Polyester Systems Safety Quiz with 100% accuracy.

Performance Guide:

1. Take notes on lecture presentation.
2. Complete reading assignment: Ransburg, Operating Your Polyester System Safely.
3. Complete the open-book Polyester Systems Safety Quiz.

FIBERGLASS: Polyester Systems Safety Quiz - Open Book

Name: ______________________ Date: ____________________

1. What is SADT? ____

2. What should you do if the pressure relief valve on the top of the catalyst tank should vent?

3. What is the recommended storage for MEKP?

4. Why should you remove all accumulations of overspray, FRP sandings, etc.?

5. Number in the correct order of the steps to remove all the pressure from the systems.
   ( ) Open the catalyst tank bleed valve.
   ( ) Open the pump safety bypass valve.
   ( ) Pull the trigger of the gun.
   ( ) Turn off the air supply to the system.
   ( ) Wait 15-20 seconds until all the pressure is gone.

6. If an accident occurs and someone gets an overspray or a catalyst in the eyes, what should be done?

7. What danger exists when running the fiberglass roving alongside of the boom hoses?

8. What should be done if you must remove the gun from the system?

9. What should you do with all hot spots?

10. How much solvent should be allowed in the laminating area?

11. Why should you always know what chemicals you are working with?

12. What is the danger in operating the airless equipment?

13-18. List six major hazards which you must guard against in polyester laminating operations.

13. ____________________ 14. ____________________

15. ____________________ 16. ____________________

17. ____________________ 18. ____________________

19. Flammable solvents should be kept in what type of containers?

20. Flammable solvents and liquid resins should be stored in a well-ventilated building at least ______ feet from the main building.

DUTY: EQUIPMENT OPERATION

TASK: Understanding the operating principles of plural component systems.

Performance Objectives:

Given a lecture presentation and reading assignments, the student will demonstrate an understanding of the operating principles of plural component systems.

Evaluation Criterion:

The student will complete the open-book Plural Component Spray Systems Quiz with 100% accuracy and Equipment Operation Test #1 with 70% accuracy without any reference materials.

Performance Guide:

1. Take notes on lecture presentation.
2. Complete reading assignments: Binks, Plural Component Spray Systems; Cooks Application Manual, pp. 11-13, 42-43.
3. Complete the open-book Plural Component Spray Systems Quiz.
4. Complete Equipment Operation Test #1.

FIBERGLASS: Plural Component Spray Systems - Open Book Quiz

Name:______________________________ Date:__________

1. What is the difference between single component systems and plural component systems?

2. Under what circumstances does the plural component remain in liquid form?

3. What equipment does the basic system require?

4. Usually the cure time takes from ________ to __________ minutes. What determines the length of the cure time?

5. How does a change in the thickness (mils) and/or temperature affect the cure time?

6. Name three types of catalyst mixing and give an equipment example for each type of mixing.

	Type of Catalyst Mixing	Equipment Example
(1)		
(2)		
(3)		

7. Name an advantage and a disadvantage of side catalyst injector systems.

Advantage:______________________________

Disadvantage:______________________________

8. Name an advantage and a disadvantage of the catalyst air injection system.

Advantage:______________________________

Disadvantage:______________________________

9. Name an advantage and a disadvantage of the split batch system.

Advantage:______________________________

Disadvantage:______________________________

FIBERGLASS: Equipment Operations Test #1

Name:_______________________________________ Date:_____________

1-4. Match the following characteristics with the proper plural component systems.

A - Batch mix

B - Side catalyst injection

C - Catalyzed air injection

D - Split batch

( ) Two equal quantities of resin are used; one containing promoter, the other catalyst.

( ) Pre-mixed catalyst and resin; a danger of cure inside lines and gun.

( ) Catalyst is injected into the resin spray in front of the gun.

( ) A catalyst/air mixture is used to atomize the resin.

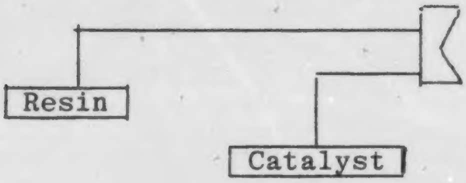
5-19. Categorize each of the following according to (1) the type of atomization, (2) the type of catalization, and (3) the type of fluid delivery.

	Type of atomization	Type of catalization	Type of fluid delivery
Binks Airless			
Binks 69 GW			
Binks Model 62			
Binks Model 15 Touch-up			
Glascraft ISD			

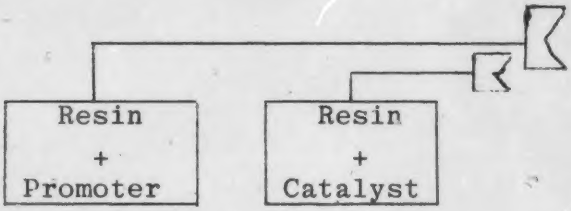
20-23. Match the following:

(A) Batch mix
(B) Split batch
(C) Internal mix catalyst injection
(D) External mix catalyst injection

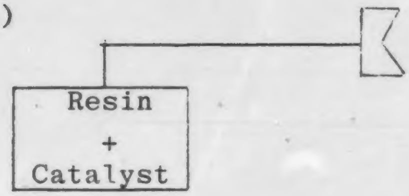
( )


Resin
Catalyst

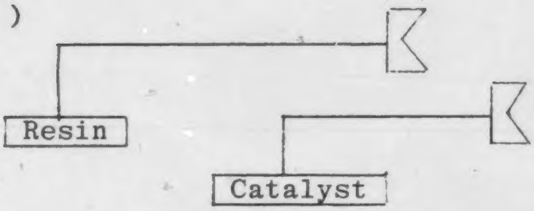
( )


Resin + Promoter
Resin + Catalyst

( )


Resin + Catalyst

( )


Resin
Catalyst

FIBERGLASS:

UNIT VI - CHOPPER OPERATION

This unit consists of classroom and laboratory activities designed to teach the student to operate and maintain fiberglass chopper equipment.

Tasks Covered:

1. Learn the operating procedures for the airless chopper equipment.
    a. Airless Chopper Operation Test
    b. Airless Chopper Components Identification Test
2. Operate the airless chopper equipment.
3. Learn the operating procedures for the air-atomized chopper equipment.
    a. Air-Atomized Chopper Operation Test
4. Operate the air-atomized chopper equipment.
5. Calibrate the chopper equipment.
    a. Chopper Calibration Form
6. Demonstrate production-level chopper operation competency.
7. Perform tool room duty.
    a. Master Inventory Ledger
    b. Tool Room Ledger

DUTY: CHOPPER OPERATION

TASK: Learn the operating procedures for the airless chopper equipment.

Performance Objectives:

Given a lecture presentation, handouts, and a reading assignment, the student will demonstrate a knowledge of the operating procedures for the airless chopper equipment.

Evaluation Criterion:

The student will complete the Airless Chopper Operation Test and the Airless Chopper Component Identification Test with 70% accuracy.

Performance Guide:

1. Take notes on lecture/presentation.
2. Complete reading assignments: Handouts, *Cook's Manual*, pp. 46-50.
3. Complete the Airless Chopper Operation Test and the Airless Chopper Component Identification Test.

FIBERGLASS: Airless Chopper Operation Test

Name: ______________________________ Date: ______________

1. What is the shut-down procedure for the resin spray-tip?

2. A catalyst spray-tip is (stainless steel or tungsten carbide).

3. Spray-tips must be set (a) vertically, (b) horizontally, or (c) resin horizontally, catalyst vertically.
Answer: ____________

4-8. Write in the following settings:

4. Atomizing air: _____ psi
5. Catalyst pot: _____ psi
6. Resin pump: _____ psi
7. Chopper: _____ psi
8. Flow-meter: _____ psi on (upper or lower) ball.

9. The roller pressure is adjusted (internally or externally) on the Binks chopper.

10. What is the shut-down procedure for a resin pump?

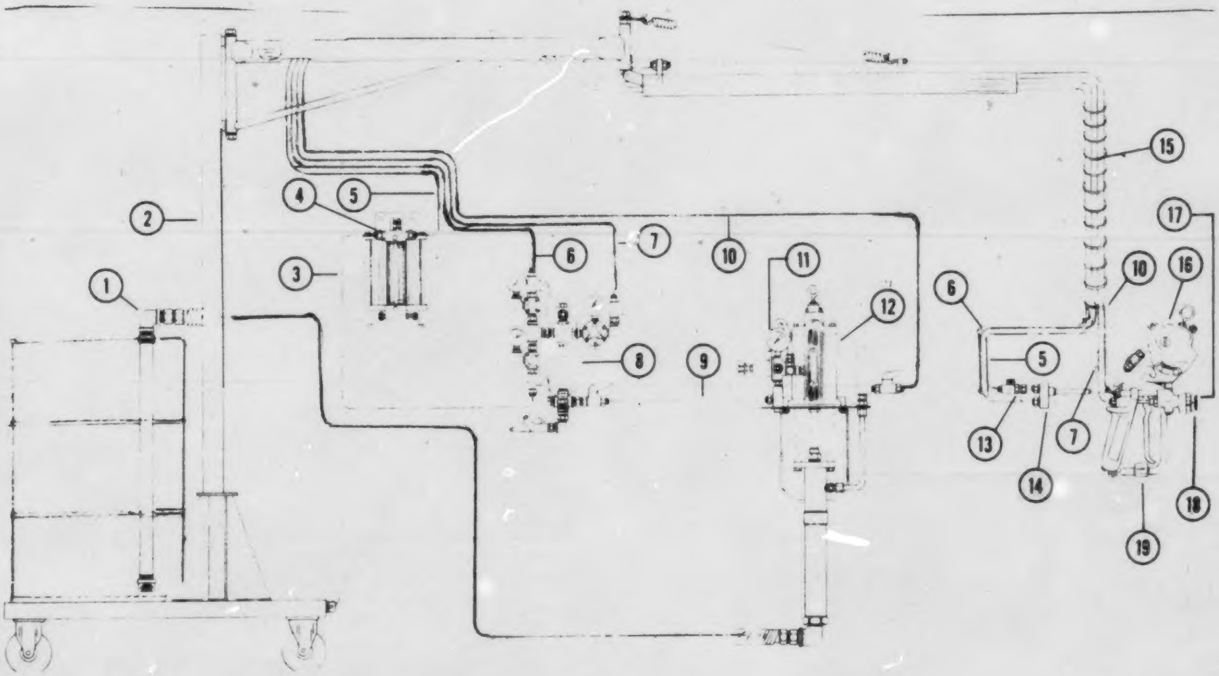
FIBERGLASS: Airless Chopper Components Identification Test

Name: ______________________________ Date: ______________

Match each of the numbered components in Binks Airless Chopper System with correct descriptions.

(   ) ACI valve
(   ) Air supply to resin pump
(   ) Atomizing air hose to gun
(   ) Boom
(   ) Bypass valve
(   ) Catalyst hose to gun
(   ) Catalyst pot
(   ) Catalyst pot air supply
(   ) Catalyst spray-tip (stainless steel)
(   ) Chopper

(   ) Chopper air to gun
(   ) Hose wrap
(   ) Mavrick gun
(   ) Plug groove valve
(   ) Resin hose to gun
(   ) Resin pump
(   ) Resin pump regulator
(   ) Resin pump tip: (tungsten carbide)
(   ) Syphon hose
(   ) Water trap



DUTY: CHOPPER OPERATION

TASK: Operate the airless chopper equipment.

Performance Objectives:

Given the airless chopper system, the student will set up, operate, and shut down the equipment.

Evaluation Criterion:

The student will set up the airless chopper equipment and spray a panel laminate. The laminate will have an even thickness of approximately 1/8". The student will then shut down the equipment.

Performance Guide:

1. Assemble the resin spray tip.
2. Turn on the air supply; drain water traps.
3. Set regulators: Atomizer air - 20 psi; Catalyst - 25 psi; Resin pump - 35 psi; Chopper - 50 psi.
4. Cycle resin through bypass; oil packing nut.
5. Test spray: Check the chopper alignment and glass/resin ratio; set the catalyst flow-meter at 50 on the upper ball.
6. Spray a 2' x 3' panel laminate.
7. Roll out the laminate.
8. Cycle the resin pump to the bottom of the stroke; oil packing nut.
9. Turn off the air supply.
10. Remove the resin spray tip; soak in acetone.
11. Clean gun, hoses and gauges with an acetone-saturated cloth.

DUTY: CHOPPER OPERATION

TASK: Learn the operating procedures for the air-atomized chopper equipment.

Performance Objectives:

Given a lecture presentation and handout reading material, the student will demonstrate a knowledge of the operating procedures for the air-atomized chopper equipment.

Evaluation Criterion:

The student will complete the Air-Atomized Chopper Operation Test with 70% accuracy.

Performance Guide:

1. Take notes on the lecture presentation.
2. Read the handout material.
3. Complete the Air-Atomized Chopper Operation Test.

FIBERGLASS: Air-Atomized Chopper Operation Test

Name: ______________________________ Date: _______________

1. To prevent uncatalyzed parts, you must never spray with atomizing air pressure set below ________ psi.

2. The rate of catalyst flow is determined by ______________.

3. What type of catalyst flow is obtained when the atomizing air pressure and the catalyst tank pressure are equal?

   ____

4. What is the function of the catalyst test valve?

   ____

5. (Atomizing air pressure regulator) or
   (Catalyst tank pressure regulator) should be adjusted for minor catalyst flow rate changes.

6. How would catalyst flow-rate be affected by an increase in the atomizing air pressure?

   ____

7. When is it necessary to bleed off the catalyst tank pressure to zero and perform the reset instructions?

   ____

8-12. Give the range of settings and the current readings for the following gauges.

	Range of Settings	Current Reading
Air supply regulator		
Solvent pump regulator		
Resin pump regulator		
Atomization air regulator		
Catalyst tank regulator		

13. How often should the chopper motor be oiled in a full-production situation? ______________________

14. (T) (F) The chopper motor is oiled through the blower control valve.

15. List the five parts replaced by the safety plug:

(1) ____________________ (2) ____________________

(3) ____________________ (4) ____________________

(5) ____________________

16. The catalyst test valve button must be depressed when setting the atomization air and catalyst regulators in order to obtain (correct pressure gauge readings) or (correct flow-meter readings).

17. What special precaution must be taken when depressing the catalyst test valve?

____

18. Describe the adjustment procedure necessary if the roving collects on one side of the spray patter with excess resin on the other.

____

19. Indicate the lengths of the glass fiber obtained by the use of the following blades:

8: ____________________ 4: ____________________

2: ____________________ 1: ____________________

20. What is the purpose of the eccentric nut mounting on the chopper cutter head?

____

DUTY: CHOPPER OPERATION

TASK: Operate the air-atomized chopper equipment.

Performance Objectives:

Given the air-atomized chopper system, the student will set-up, operate, and shut down the equipment.

Evaluation Criterion:

The student will set up the air atomized chopper equipment and spray a panel laminate. The laminate will have an even thickness of approximately 1/8". The student will then shut down the equipment.

Performance Guide:

1. Check catalyst, resin and solvent quantity.
2. Open main air valve.
3. Install retaining ring, spray tip, grid, fluid nozzle and diffuser in gun. Place C-368 safety plug in CLEAN solvent.
4. Adjust resin pressure regulator to desired setting.
5. Adjust the atomizing air pressure (while depressing catalyst test valve). MINIMUM: 22 psi.
6. While depressing catalyst test valve, slowly rotate the catalyst pressure regulator knob clockwise until the desired catalyst pressure reading is obtained. Must be at least 2 psi higher than atomizing air pressure.
7. Open air bleed valve for several seconds to relieve any excess pressure. Close securely.
8. Spray a 2' x 3' panel laminate.
9. Roll out the laminate.
10. Depress purging buttons simultaneously and hold for five seconds.
11. Rotate trigger bar to "CUTTER ONLY".
12. Remove retaining ring, spray tip, grid, fluid nozzle and diffuser and place in CLEAN solvent. Install C-368 safety plug.

TASK: Operate the air-atomized chopper equipment - Page 2

Performance Guide (cont.):

13. Unscrew cutter motor speed adjustment needle valve; insert 6-8 drops of lightweight machine oil; replace needle valve; run cutter for five seconds WITH BLOWER CONTROL NEEDLE CLOSED.
14. Clean off entire gun with a solvent-soaked rag. Oil all trigger parts, valve stems and exposed threads.
15. Turn off main valve. DO NOT BLEED RESIN or CATALYST HOSES.
16. Leave gun hanging in down-pointed position.

DUTY: CHOPPER OPERATION

TASK: Calibrate the chopper equipment.

Performance Objectives:

Given a lecture presentation, a chopper calibration procedure sheet and a chopper calibration form, the student will calibrate the chopper equipment.

Evaluation Criterion:

The student will calibrate the chopper equipment. The gel-time will be 18 ± 3 minutes. The glass percentage will be 30 ± 5%.

Performance Guide:

1. Record time, date, temperature and humidity, and all gauge and flow-meter readings.
2. Tare-weigh a gallon can.
3. Spray resin and catalyst into the can for 10 seconds.
4. Start the gel-time meter.
5. Weigh the catalyzed resin sample and subtract the tare and multiply by 6 for resin-per-minute.
6. Pour a part of the resin sample into a cup and place on the gel-time meter.
7. Tare-weigh a plastic-lined box.
8. Run the chopper into the box for 10 seconds.
9. Weigh, subtract the tare, and multiply by 6 for glass-per-minute.
10. Add resin and glass (Total).
11. Divide glass by total; multiply by 100 for percentage of glass.
12. If gel-time and/or glass percentage do not meet specifications, readjust and recheck.

FIBERGLASS: Chopper Calibration Form

Name: ______________________________ Date: _______________

Time: _______________

Gauge Readings:

Catalyst: ____________________ Temperature: _______________

Atomizing Air: _______________ Humidity: ________________

Chopper Regulator: ___________ Resin Number: ______________

Resin: _______________________ Catalyst Type: _____________

Flow-meter: __________________

****

Weight of resin sample with can: ....

Minus tare weight: – _______________

Equals resin sample: ....

Times 6: X 6

Equals resin-per-minute (A): ....

Gel-time: _______________

Glass sample with box: ....

Minus tare weight: – _______________

Equals glass sample: ....

Times 6: X 6

Equals glass-per-minute (B): ....

Add (A) and (B) for Total (C): (A) ....

+(B) __________

(C) ....

Divide (B) by (C); then multiply by 100 for percentage of glass:

$\frac{(B)}{(C)} = (D)$ (D) X 100 = percentage of glass

DUTY: CHOPPER OPERATION

TASK: Demonstrate production-level chopper operation competency.

Performance Objectives:

Given a chopper system and a prepped chairseat mold, the student will demonstrate production-level chopper operation competency.

Evaluation Criterion:

The student will spray and roll out a chairseat mold within 10 minutes. The laminate will be of even thickness of approximately 1/8". There will be no lamination defects.

Performance Guide:

1. Test spray: Check for chopper alignment, glass/resin ratio, and flow-meter reading.
2. Spray the mold.
3. Flush the gun.
4. Roll out the laminate.

DUTY: CHOPPER OPERATION

TASK: Perform tool room duty.

Performance Objectives:

Given a fully stocked tool room and a ledger, the student will serve as a tool room attendant.

Evaluation Criterion:

The student will remain in the tool room during duty and keep a master inventory ledger and ledger of tools checked out and in by other students. All tools will be returned and properly stored at the end of duty.

Performance Guide:

1. Prepare a master inventory ledger.
2. Remain in tool room during duty.
3. Check out tools as they are requested.
4. Check in tools as they are returned.
5. Store tools and balance two ledgers.
6. Submit the ledgers to the instructor.

FIBERGLASS: Master Inventory Ledger

Attendant:______________________________ Date:______________

Tool Room Hours:____________________ to _____________________

Item	Quantity	Initial Check	Final Check
Air grinder	1		
Air nozzle	1		
Air regulators	2		
Brushes: 1"	32		
2 1/2"	1 bx + 6		
4"	4		
scrub	3		
wire	3		
Chisel: regular	2		
wood	4		
Clamps	2		
Crow Bars: long	2		
short	1		
Metal Cutters	3		
Drill	1		
Funnel (small plastic)	3		
Grinding Wheel	1		
Hammers: claw	2		
tack	2		
Hole Bits	16		
Hex Key Set	1		

FIBERGLASS: Master Inventory Ledger

Attendant:______________________________ Date:_________________

Tool Room Hours:______________________ to _____________________

Item	Quantity	Initial Check	Final Check
Knives: 1 1/4" degreasing	2		
1 1/4" putty	1		
new cutting	10		
new putty	16		
slim trim	1		
Mallet (rubber)	6		
Miter Boxes	2		
Jiffy Mixers	2		
Pliers	2		
Punches	3		
Rollers: aluminum	9		
giant	2		
large	2		
medium	1		
radius	5		
small 6"	14		
Sanders: air (and grinders)	7		
disc	6		
hand	7		
long hand	3		

FIBERGLASS: Master Inventory Ledger

Attendant:______________________________ Date:________________

Tool Room Hours:____________________ to ______________________

Item	Quantity	Initial Check	Final Check
Sanding Blocks	6		
Saws: 7 1/4" Builders	1		
7 1/4" Circular	1		
hack	2		
Sabre (electric)	1		
Scissors	3 pr.		
Screw Drivers: Phillips	4		
Straight-			
large	4		
medium	2		
small	5		
Catalyst Spigot	1		
Square	1		
Taps	2		
Trimmer	1		
Wrenches: Bung - 1 1/2"	1		
1 3/4"	1		
Crescent-large	4		
medium	3		
small	2		

FIBERGLASS: Master Inventory Ledger

Attendant:____________________ Date:____________

Tool Room Hours:______________ to ______________

Item	Quantity	Initial Check	Final Check
Wrenches: Hex	19		
Pipe - 10"	1		
14"	3		
18"	1		
Vise grips	3		

FIBERGLASS: Tool Room Ledger (Check out/in)

Tool Room Attendant:_______________________ Date:____________

Name	Item	Check out Time	Check in Time

FIBERGLASS:

UNIT VII - GEL-COAT EQUIPMENT

This unit consists of classroom and laboratory activities designed to teach the student how to operate and maintain the gel-coat equipment.

Tasks Covered:

1. Perform the airless gel-coat operation.
    a. Operational Procedures
    b. Airless Gel-coat Operation Test
2. Perform the air atomized gel-coat operation.
    a. Operational Procedures
    b. Air Atomized Gel-coat Operation Test
3. Perform the equipment calibration.
    a. Airless Gel-coat Calibration Form
4. Operate the gel-coat equipment at the production level competency.
5. Serve as a tool room attendant.

DUTY: OPERATING THE GEL-COAT EQUIPMENT

TASK: Perform the airless gel-coat operation.

Performance Objective:

Given an airless gel-coat system and a prepped mold, the student will learn the correct operating procedures, and operate the airless gel-coat equipment.

Evaluation Criterion:

The student will demonstrate a knowledge of the airless gel-coat operation procedures by completing the Airless Gel-coat Operation Test with 70% accuracy without any reference materials and by passing a performance test in the lab.

The student will operate the airless gel-coat system, including the set-up and the shut-down of the system, in accordance with the prescribed procedural steps in the handouts.

Performance Guide:

1. Read the handout materials and Cook's Manual, pp. 8-29.
2. Participate in lecture/discussion.
3. Observe the lab demonstration.
4. Complete the Airless Gel-coat Operation Test.
5. Complete the performance test in the lab, following the operation procedures* for the set-up, the shut-down, and the spray-method injection for the airless gel-coat system.

*See the attached page for the correct procedures.

FIBERGLASS:

Operational Procedures for Airless Gel-coat System

Set-up:

1. Turn on air to catalyst supply system.
2. Set main regulator at 45 psi.
3. Set pressure to the ACI valve at 20 psi.
4. Set pressure to the catalyst tank at 25 psi.
5. Turn on air to the gel-coat pump.
6. Oil the upper packing.
7. Check that the bypass valve is closed.
8. Set the regulator at 50 psi (up to 90 if necessary). Loosen upper packing-nut if necessary.
9. Insert the bypass tube in barrel and open; cycle at least six times or until operating evenly.
10. Check the spray pattern and catalyst flow through two cycles.

Shut-down:

1. Turn off the air valve; back off three regulators on the catalyst side.
2. SLOWLY release the catalyst tank pressure through the relief valve.
3. Set the gel-coat pump at the bottom of stroke by opening the bypass valve.
4. Turn off the air valve; back off the regulator.
5. Turn off the main air valve; release pressure.
6. Trigger gun into water to release the remaining line pressure.
7. Clean the gun, hoses and gauges with an acetone soaked rag.

Gel-coat spray methods: Airless catalyst injection:

1. Drain water from the traps daily.
2. Check the gel-coat pressure for a good spray pattern: A high pressure causes the excessive floating of the mist; a low pressure causes a loss of pattern between pump strokes.
3. Check catalyst flow at the nozzle and flow-meter; adjust according to temperature and humidity.
4. Trigger the gun away from the mold.
5. Do not trigger the gun at the end of stroke.
6. Keep the gun perpendicular to the mold surface.
7. Do not arc the gun except when breaking stroke in the middle of a panel.

FIBERGLASS:

Operational Procedures for Airless Gel-coat System - page 2

Gel-coat spray methods: (cont.)

8. Keep the gun parallel to the mold surface.
9. The spray pattern is best at a minimum distance of 1-1/2 feet or a maximum of three feet from the mold.
10. Adjust the stroke speed to achieve a full wet coat of 5-7 mils per pass. Three passes should total 18 ± 2 mils.
11. Overlap strokes by 1/3 to 1/2.
12. Overlap edges by 1/3 to 1/2.
13. Cover all the hard to reach areas first.
14. Inspect gun and hoses regularly for leaks.
15. Clean gun, hoses and gauges after use.

FIBERGLASS: Airless Gel-coat Operation Test

Name: ______________________________ Date: ______________

1. On Bink's airless gel-coat system, the main regulator on the catalyst supply system should be set at ______ psi.
2. The catalyst pot pressure regulator should be set at _______ psi.
3. The ACI (air-catalyst integrator) regulator should be set at ________ psi.
4. Regulator on the gel-coat pump should be set at _____ psi.
5. As the packing clogs up, the pressure can be raised to a maximum of ______ psi.
6. (T) (F) Catalyst injected gel-coat guns should be triggered at the end of each stroke.
7. (T) (F) Batch mix gel-coat guns should be triggered at the end of each stroke.
8. A higher ball-reading on the catalyst pot flow-meter tube means (more or less) catalyst and a (shorter or longer) cure time.
9. (T) (F) Gel-coat and catalyst pressures within the system must be bled off as part of the shut-down procedures.
10. What adverse effect will result from arcing the gun?
11. What is the function of the ACI valve?
12. What is the minimum distance between the airless spray gun and the mold surface?
13. What adverse effect will result from decreasing this distance?
14. What is the maximum distance?
15. What adverse effects will result from increasing this distance?
16. Why are you instructed to avoid triggering the gun at the end of the stroke?

FIBERGLASS: Airless Gel-coat Operation Test - page 2

17. Currently, the flow-meter reading should be approximately __________ on the (upper or lower) ball.

18. What three factors determine the amount of gel-coat deposited on the mold surface while spraying?

a.

b.

c.

DUTY: GEL-COAT EQUIPMENT OPERATION

TASK: Perform the air atomized gel-coat operation.

Performance Objective:

Given an air atomized gel-coat system, a prepped fiberglass mold, the student will learn the operating procedures for the air atomized gel-coat equipment and perform the lab operation of the system.

Evaluation Criterion:

Student will demonstrate a knowledge of the operating procedures by completing the Air Atomized Gel-coat Operation Test with 70% accuracy and by passing a performance test in the lab without reference materials.

The student will follow the correct procedural step. The gel-coat will be sprayed to a thickness of 18 ± 2 mils.

Performance Guide:

1. Read the handout materials and Cook's Manual, pp. 8-29.
2. Participate in lecture/discussion.
3. Observe the lab demonstration.
4. Complete the Air Atomized Gel-coat Operation Test.
5. Complete the performance test in the lab following the operational procedure.*

* See the attached page for the operating procedures.

FIBERGLASS:

Operating Procedures for Air Atomized Gel-coat Equipment

1. Set the main regulator at 65 psi.
2. Pour approximately one pint of acetone into a pot and attach the pot to cover.
3. Set the pot regulator at 15 psi.
4. Open the air cut-off valve.
5. Spray. Watch for a good spray pattern. If the pattern is faulty, disassemble and clean the nozzle.
6. Remove the pot; fill half with acetone.
7. Fill another pot with gel-coat and catalyze.
8. Attach gel-coat pot; test for the pattern.
9. Spray the mold.
10. Remove the gel-coat pot; attach the acetone pot and shake.
11. Close the air cut-off valve.
12. Spray acetone into gel-coat pot.
13. Disassemble and clean all components.

FIBERGLASS: Air Atomized Gel-coat Operation Test

Name: ________________________________ Date: ______________

1. The most efficient atomization air pressure is the (lowest or highest) pressure that will give a proper spray pattern.

2. To obtain the most rapid coverage, the fluid adjusting valve should be turned (in or out).

3. A vertical spray pattern will be obtained by setting the wings on the nozzle (vertically or horizontally).

4. The above setting will be used for (vertical or horizontal) strokes.

5. The distance between the mold surface and the gun nozzle should be ____.

6. The batch mix pressure pot system (should or should not) be triggered at the end of each stroke.

7. A clog in one wing side-port will create a (split or crescent-shaped or egg-shaped) pattern.

8. A clog at the center opening of the air nozzle will create a (split or crescent-shaped or egg-shaped) pattern.

9. Give one possible cause of splitting.

10. What is most often at fault when the pot regulator registers pressure but no fluid is obtained at the nozzle?

11. What clean-up step must be taken before catalyzing the gel-coat?

12. The air cut-off valve should be (open or closed) while flushing the gun.

13. The air supply regulator should be set at ______ psi.

14. The fluid pressure regulator should be set at _______ psi.

DUTY: GEL-COAT EQUIPMENT OPERATION

TASK: Perform the equipment calibration.

Performance Objectives:

Given a calibration form, gel-coat spray system, a thermometer, a gel-time meter, a large container and a one-pint cup, the student will learn calibration procedures for various types of gel-coat equipment.

Evaluation Criterion:

The student will demonstrate a knowledge of calibration procedures by performing successfully in the lab the calibration of the equipment. The gel-time will conform to the specifications.

Performance Guide:

1. Read the handout materials and Cook's Manual, pp. 30-33.
2. Participate in lecture/discussion.
3. Perform the calibration using the form.

FIBERGLASS: Airless Gel-coat Calibration Form

Name: ______________________________ Date: ______________

1. Set up the gel-coat system as specified.
2. Spray approximately one pint of the sample into a large container.
3. Note the flow-meter reading.
4. Start the gel-time meter immediately.
5. Pour the sample into one-pint cup and place on the gel-time meter.
6. Record the following:

   Date ______________________
   Time ______________________
   Temperature ______________________
   Humidity ______________________
   Product code number ______________________
   Batch number ______________________
   Flow-meter reading ______________________
   Gel-time ______________________

7. If gel-time is not within specifications, adjust the catalyst flow-meter valve and repeat the steps 2 through 5.

DUTY: GEL-COAT EQUIPMENT OPERATION

TASK: Operate the gel-coat equipment at production level competency.

Performance Objectives:

Given gel-coat spray equipment and three prepped fiberglass chair molds, the student will demonstrate production level competency in the gel-coat equipment operation.

Evaluation Criterion:

The student will gel-coat three fiberglass chair molds within ten minutes. Gel-coat thickness will be 18 ± 2 mils.

Performance Guide:

1. Participate in lecture/discussion.
2. Practice the gel-coat operation.
3. Complete the performance test in lab.

DUTY: GEL-COAT EQUIPMENT OPERATION

TASK: Serve as a tool room attendant.

Performance Objectives:

Given a fully stocked tool room and a ledger form, the student will serve as a tool room attendant.

Evaluation Criterion:

The student will remain in the tool room during the duty hour and will keep a ledger of tools checked out and in by other students. All tools will be returned and properly stored at the end of the period.

Performance Guide:

1. Remain in tool room during the duty hour.
2. Check out tools as they are requested.
3. Check in tools as they are returned.
4. Store tools and balance the ledger.
5. Submit the ledger to the instructor.

FIBERGLASS:

UNIT VIII - FINISH AND REPAIR

This unit consists of laboratory experience performing various types of repair procedures.

Tasks Covered:

1. Identify repair materials and explain their use.
2. Identify repair tools and explain their use.
3. Restore the gloss.
4. Sand the gel-coat to remove surface imperfections.
5. Repair gel-coat defects which do not enter the laminate.
6. Repair a small hole which enters but does not penetrate through the laminate.
7. Repair fractures or holes which penetrate through the laminate.
8. Respray a small area with gel-coat.

DUTY: FINISH & REPAIR

TASK: Identify repair materials and explain their use.

Performance Objectives:

Given a lecture presentation, a reading assignment, and an assortment of repair materials, the student will identify and explain the use of the following materials: 3/4 oz. mat, 1-1/2 oz. mat, fiberglass cloth, woven roving, cab-o-sil, milled fibers, resin, gel-coat, catalyst, acetone, celophane, PVA, sandpaper (220 grit, 400 grit, 600 grit), buffing compound, and wax solution.

Evaluation Criterion:

Without reference materials, the student will correctly identify and explain the use of the repair materials listed above.

Performance Guide:

1. Take notes on lecture presentation.
2. Read FERRO Fiberglass Repair Manual, Chapter 1.
3. Inspect various repair material samples.
4. Identify and explain the use of each material.

DUTY: FINISH & REPAIR

TASK: Identify repair tools and explain their use.

Performance Objectives:

Given a lecture presentation and the following tools, the student will identify and explain the use of each tool: putty knife, sanding block, power buffer, power grinder, rotary burr, disc sander, orbital sander, trim saw, particle mask, goggles, and touch-up gun.

Evaluation Criterion:

Without reference materials, the student will correctly identify and explain the use of the repair tools listed above.

Performance Guide:

1. Take notes on lecture presentation.
2. Inspect the various repair tools presented.
3. Identify and explain the use of each tool.

DUTY: FINISH & REPAIR

TASK: Restore gloss.

Performance Objective:

Given a de-glossed FRP part, a power buffer, a buffing pad, a cloth, buffing compound, and acetone, the student will restore the gloss to the part.

Evaluation Criterion:

The student will restore the gloss to a FRP part following the correct procedure. No surface imperfections will be evident.

Performance Guide:

1. Select the tools and materials listed above.
2. Clean the damaged surface using a cloth saturated with acetone.
3. Attach buffing pad to buffer.
4. Oil buffer.
5. Holding the buffer at a 45° angle, buff the part with medium pressure.
6. Holding the buffer flat, finish buff with light pressure.
7. Clean up the work area and return tools and unused materials.

DUTY: FINISH & REPAIR

TASK: Sand the gel-coat to remove surface imperfections.

Performance Objective:

Given a FRP part with surface scratches, a power buffer, a buffing pad, buffing compound, a sanding block, acetone, water and sandpaper (220, 400, 600 grit), the student will remove the surface scratches.

Evaluation Criterion:

The student will remove the surface scratches following the procedure listed below. No surface imperfections will be evident.

Performance Guide:

1. Select the necessary tools and materials.
2. Clean the damaged surface using a cloth saturated with acetone.
3. Block-sand with 220 grit until the scratch disappears. CAUTION: Use a particle mask when dry-sanding.
4. Clean the surface with a cloth saturated with water.
5. Wet-sand with 400 grit, then with 600 grit.
6. Restore the gloss. Follow the correct procedures.
7. Clean up the work area; return tools and unused materials.

DUTY: FINISH & REPAIR

TASK: Repair gel-coat defects which do not enter the laminate.

Performance Objective:

Given a FRP part with an air bubble under the gel-coat, a rotary burr, putty knife, acetone, cloth, gel-coat, cab-o-sil, catalyst, cellophane and a razor blade, the student will repair the air bubble.

Evaluation Criterion:

The student will repair the air bubble following the correct procedure. No surface imperfections will be evident.

Performance Guide:

1. Select the necessary tools and materials.
2. Remove all damaged gel-coat with the rotary burr.
3. Clean the surface using a cloth saturated with acetone.
4. Mix cab-o-sil thoroughly with a matching gel-coat.
5. Add catalyst to gel-coat putty.
6. Build up the damaged area 1/4" above surface with a catalyzed putty.
7. Cover with cellophane and squeegee out excess putty with a putty knife or smooth with a putty knife and coat with PVA.
8. Allow to harden; remove cellophane or PVA.
9. Sand the patch. Follow the prescribed procedures.
10. Restore the gloss. Follow the prescribed procedures.
11. Clean up the work area; return tools and unused materials.

DUTY: FINISH & REPAIR

TASK. Repair a small hole which enters but does not penetrate through the laminate.

Performance Objective:

Given a FRP part with a small hole which enters but does not penetrate through the laminate, a rotary burr, putty knife, resin, milled fibers, catalyst, cloth and acetone, the student will repair the damage.

Evaluation Criterion:

The student will repair the damage following the correct procedure. No surface imperfections will be evident.

Performance Guide:

1. Select the necessary tools and materials.
2. Remove all damaged material with the rotary burr.
3. Clean the surface using a cloth saturated with acetone.
4. Mix milled fibers thoroughly with resin.
5. Add catalyst to the putty.
6. Fill the hole with the putty.
7. Allow to harden.
8. Open the hole to just below the gel-coat level with rotary burr.
9. Repair the gel coat. Follow the prescribed procedures.
10. Restore the gloss. Follow the prescribed procedures.
11. Clean up the work area; return tools and unused materials.

DUTY: FINISH & REPAIR

TASK: Repair fractures or holes which penetrate through the laminate.

Performance Objectives:

Given a FRP part with a fracture which penetrates the laminate, a power grinder, mat, scissors, resin, catalyst, acetone, roller, brush, cardboard, tape, wire, cloth and cellophane, the student will repair the damage.

Evaluation Criterion:

The student will repair the damage following the correct procedure. The repaired part will be structurally sound. No surface imperfections will be evident.

Performance Guide:

1. Select the necessary tools and materials.
2. Using the power grinder, remove all damaged material and feather the edge back 2 inches from the hole. CAUTION: Use a particle mask and goggles when grinding.
3. a. If the unfinished side is accessible, tape a piece of cellophane-covered cardboard to the back of the hole.
   b. If the unfinished side is inaccessible, push the cardboard through the hole and secure with wires passed through the hole.
4. Clean the area using a cloth saturated with acetone.
5. Cut mat patches to fit the damaged area.
6. Saturate the mat with the catalyzed resin.
7. Place the saturated mat over the damaged area and remove air with a roller or brush.
8. Continue applying the mat until patch is level with the surface.
   a. If the unfinished side is accessible, remove the cardboard, grind away any damaged material, and apply a mat patch.
   b. If the unfinished side is inaccessible, cut wires used to hold cardboard.

TASK: Repair fractures or holes which penetrate through the laminate -- page 2

Performance Guide (cont.):

10. Grind the patch down to just below gel-coat level. CAUTION: Use a particle mask and goggles when grinding.
11. Repair the gel-coat. Follow the prescribed procedures.
12. Restore the gloss. Follow the prescribed procedures.
13. Clean up the work area; return tools and unused materials.

DUTY: FINISH & REPAIR

TASK: Respray a small area with gel-coat.

Performance Objective:

Given a FRP part with surface imperfections, gel-coat, catalyst, wax solution, tape, sandpaper, paper, acetone, cloth and a touch-up gun, the student will respray a small area with gel-coat.

Evaluation Criterion:

The student will respray a small area with gel-coat following the correct procedure. No surface imperfections will be evident.

Performance Guide:

1. Select the necessary tools and materials.
2. Tape around the area to be resprayed.
3. Cover the adjacent areas with paper.
4. Sand the area to be sprayed.
5. Thin gel-coat with wax solution by 10%.
6. Fill a touch-up gun with the thinned gel-coat.
7. Add catalyst.
8. Test spray.
9. Spray the damaged area; clean the touch-up gun.
10. Allow to cure; remove tape and paper.
11. Sand the patch. Follow the prescribed procedures.
12. Restore the gloss. Follow the prescribed procedures.
13. Clean up the work area; return tools and unused materials.

FIBERGLASS:

UNIT IX - MOLD-MAKING

This unit consists of classroom and laboratory activities designed to teach the student the various principles, terms, and procedures used in mold-making.

Tasks Covered:

1. Understand the mold-making processes.
    a. Mold-Making Test #1
    b. Mold-Making Test #2
    c. Mold-Making Test #3
2. Sand to produce a level surface.
3. Build a mold from an existing plug.
4. Perform the Mirro-Glaze process.

DUTY: MOLD-MAKING

TASK: Understand the mold-making processes.

Performance Objective:

Given a reading assignment and lectures, the student will become familiar with the terms and various tooling operations in FRP and complete three tests on mold-making:

Test #1: Tooling terms, and mold designs.
Test #2: Woodplug construction, sanding techniques, and Mirro-Glaze process.
Test #3: Mold-building.

Evaluation Criterion:

The student will complete all three tests on tooling with 70% accuracy without any reference materials.

Performance Guide:

1. Complete the reading assignment: Cook's Manual, pp. 51-53; Owens/Corning: Design, Construction, and Maintenance of Reinforced Plastic Hand Lay-up Molds.
2. Participate in lecture/discussion.
3. Complete the three tests on mold-making.

FIBERGLASS: Mold-Making Test #1

Name:______________________________ Date:__________

1-2. Explain the two ways in which a tooling resin differs from a general purpose resin.

1. ______________________________

2. ______________________________

3. Under what conditions should tooling gel-coat be specified?

4. Under what conditions should tooling resin be specified?

5. Exhibit C is a ______________ which has a shape (complementary or identical) to the part.

6. Exhibit B is a ______________ which has a shape (complementary or identical) to the part.

7. Exhibit A is the part. It has a (male or female) shape.

8. Which of the exhibits could be referred to as a tool?______

9-13. Define the following:

Plug:______________________________

Mold:______________________________

Glassmaster:______________________________

Tool:______________________________

Prototype:______________________________

14. What is the minimum advisable release angle?______________

15. What is the minimum advisable radius?______________

16. Where should the blow holes be located?______________

17. What is the recommended air pressure to be applied to the blow hole?

18. What is the principal means used by the designer to increase the structural integrity without increasing weight? Give an example.

19. Draw a cross-sectional diagram of a wood plug.

20. Draw a cross-sectional diagram of a glass master.

FIBERGLASS: Mold-Making Test #2

Name:______________________________ Date:__________

1. Why is it necessary to build the wood substructure of a female plug slightly larger than the desired dimensions of the part? Circle the correct answer.

   a. It is better to build too large and cut down than to build too small, and start over.

   b. To allow for the addition of one laminate and three coats of gel-coat.

   c. To allow for a shrinkage of the part.

2. It is necessary to build the wood substructure of a male plug slightly (larger or smaller) than the desired dimensions of the part.

3-11. Number the following plug construction steps in correct order:

( ) 3. fill or grind radii
( ) 4. coat entire plug with resin
( ) 5. black sand
( ) 6. apply one laminate of FRP
( ) 7. spray 40 mils of tooling gel-coat
( ) 8. build wood substructure
( ) 9. spray 29 mils white gel-coat
( )10. wet-sand
( )11. perform Mirro-Glaze process

12. What type of strokes should be used when block-sanding?

13. What type of strokes should be used when wet-sanding?

14-15. What two steps must be performed when changing grits of wet-sandpaper?

14.______________________________

15.______________________________

16-23. Outline 8 steps in the Mirro-Glaze process:

16.______________________________
17.______________________________
18.______________________________
19.______________________________
20.______________________________
21.______________________________
22.______________________________
23.______________________________

24. Describe procedures for application of machine glass.

25. Describe the procedure for the application of PVA.

FIBERGLASS: Mold-Making Test #3

Name:_________________________________ Date:__________

1. Why is it necessary to spray a tooling gel-coat test panel before spraying a mold or plug?

2. Why would a gel-coat of contrasting color be used behind the tooling gel-coat on a mold?

3. What is the advantage of using a clear tooling gel-coat?

4. Why shouldn't an airless catalyst injection equipment be used to spray a tooling gel-coat?

5. Why wouldn't a tooling gel-coat be left overnight before being laminated onto?

6-7. Name two methods of preventing glass pattern print-thru.
6.______________________________
7.______________________________

8. (T) (F) Any glass pattern print-thru problems will be evident when the mold is pulled from the plug.

9. What special precaution must be taken with a metal bracing when building a mold?

10. How can soft, pliable, foam-core strips strengthen a mold?

11. How long should a mold cure before being pulled from the plug?

12. What is the recommended procedure for storing a mold?

13. What type of mat joints must be used on the first two laminates when building a mold by hand lay-ups?

14-15. List the two ways in which tooling resin differs from general purpose resin.
14.______________________________
15.______________________________

16. What is the minimum advisable release angle?______________

17. What is the minimum advisable radius?____________________

18. What purpose does PVA serve in the Mirro-Glaze process?

19. List three circumstances under which the Mirro-Glaze process would be used.

a.

b.

c.

DUTY: MOLD-MAKING

TASK: Sanding to produce a level surface.

Performance Objectives:

Given the necessary materials and tools, the student will produce a level surface on a given FRP part.

Evaluation Criterion:

The student will produce a level surface on a given FRP part without losing the correct dimensions of the product. The finished product must pass the instructor's inspection.

Performance Guide:

1. Block-sand with 40-50 grit paper to produce level surface.
    - a. Always use dust mask when dry-sanding or grinding FRP.
    - b. Use a long hand sanding block.
    - c. Use a straight stroke at opposing diagonals.
    - d. Use wood radius sanding block for inside radii.
    - e. Block-sand with 80 grit only after all dimples are gone and dimensions check.
2. Wet-sand after rechecking the dimensions carefully.
    - a. Use several drops liquid soap in water to prevent clogging.
    - b. Use circular strokes. (Fold paper in quarters.)
    - c. Wipe dry and check for scratches before changing grits.
    - d. Change water between grits.
    - e. Use at least 4 grits between 100 and 600.

DUTY: MOLD-MAKING

TASK: Build a mold from an existing plug.

Performance Objectives:

Given a plug, materials and tools necessary for making a mold, the student will construct a mold from an existing plug and produce a part on the finished mold.

Evaluation Criterion:

The student will construct a mold in accordance with the procedural steps given in the class. The finished mold will not have any structural or surface defects.

Performance Guide:

1. Apply the release agent to the plug.
2. Test the tooling gel 40 mils for porosity.
3. Apply the tooling gel-coat. Use only batch mix spray equipment.
4. Apply the back-up gel-coat 20 mils of contrasting color behind the tooling gel to indicate the sanding depth during mold refinishing.
5. Use glass veil to prevent fiber pattern print-through when high-gloss finish is critical.
6. Apply chopper laminates 1/8" thick; sand glass hairs and air pockets; allow mold to cool completely between laminates.
7. Apply 4 to 6 laminates.
8. Lay-in foam core strips and braces.
9. Apply 2 to 3 more laminates.
10. Insulate the mold from metal bracing to prevent warpage and print-thru.
11. Pull Mold.

*When building a mold by hand lay-up, use staggered butt joints on first 2 laminates, woven roving on next-to-last laminate.

DUTY: MOLD-MAKING

TASK: Perform the Mirro-Glaze process.

Performance Objectives:

Given the necessary materials and tools, the student will perform the Mirro-Glaze process on a virgin mold or a refinished part.

Evaluation Criterion:

The student will perform the Mirro-Glaze process on the virgin mold.

Performance Guide:

1. Power buff the buffing compound.
2. Apply machine cleaner; wipe on and wipe off with clean cheese cloth.
3. Apply machine glaze; wipe on and wipe off with clean cheese cloth.
4. Apply five coats wax; apply with circular motion; hand buff immediately with clean cheese cloth; allow drying time between coats.
5. Apply one coat PVA; allow to dry.
6. Pull 5 parts; apply one coat wax and one coat PVA between each.
7. Enter full production; wax only when needed.
8. Begin with step #1 when polystyrene build-up inhibits pull.

FIBERGLASS:

UNIT X - QUALITY CONTROL

This unit consists of classroom and laboratory activities designed to introduce the student to the procedures used by industry to insure product quality.

Tasks Covered:

1. Identify and explain the testing equipment of the incoming materials.
2. Perform the in-process and final inspection.
   a. In-process Check List - Mold Preparation
   b. In-process Check List - Gel-coat Station
   c. Final Inspection Check List

DUTY: QUALITY CONTROL

TASK: Identify and explain the testing equipment of the incoming materials.

Performance Objectives:

The student will learn to identify and explain the use of the following laboratory testing devices: gel-time meter, viscometer, barcol hardness tester, and foreign materials tester.

Evaluation Criterion:

The student will demonstrate a knowledge of the testing equipment in the laboratory by completing an oral examination. Each device will be correctly identified and its use explained to the satisfaction of the instructor.

Performance Guide:

1. Complete assigned readings: Cook's Manual, pp. 75-90.
2. Participate in lecture/discussion.
3. Complete the oral examination.

DUTY: QUALITY CONTROL

TASK: Perform the in-process and final inspection.

Performance Objective:

The student will learn the procedures used for the in-process and final quality control inspection.

Evaluation Criterion:

The student will demonstrate a knowledge of the quality control inspection by completing the following checklist forms on the products being produced in the lab by other students: Mold-preparation, Gel-coat, and Final. Any product defects will be noted on the checklist forms. The checklists must be approved by the instructor.

Performance Guides:

1. Participate in lecture/discussion.
2. Review the in-process and final inspection check forms.
3. Complete the checklist forms on products being produced by other students.
4. Submit the checklist forms to the instructor.

FIBERGLASS: Quality Control
In-Process Check List - Mold Preparation

Inspector: ______________________________

Date: ______________________________

	Accept	Rework	Reject
1. Visual inspection.......			
2. Waxing procedures.......			
3. Strip-down.............. (if required)			
4. Edge-taping.............			
5. I.D. number in place ...			
6. Location in place....... (if required)			
7. Surface cleared.........			
8. Ready for gel-coat......			

Mold Number: ______________________________

Operator: ______________________________

Date: ____________________ (Prepped; gel-coated; laminated)

Inspector's Comments:

Instructor's Comments:

FIBERGLASS: Quality Control
In-Process Check List - Gel-coat Station

Inspector: ______________________________

Date: ______________________________

	Accept	Rework	Reject
1. Equipment calibration ..			
2. Clean surface			
3. Color verification			
4. Coverage			
5. Thickness			
6. Cure time (in minutes)..			
7. Surface readiness for .. chopping			

Mold Number: ______________ Part Number: ______________

Operator: ______________________________

Date: ______________ (Prepped; Gel-coated; Laminated)

Inspector's Comments:

Instructor's Comments:

FIBERGLASS: Quality Control
Final Inspection Check List

Inspector: ______________________________

Date: ______________________________

	Accept	Rework	Reject
1. Surface appearance			
2. Part thickness			
3. Air pocket or bubbles			
4. Delamination			
5. Dimensional			
6. Fabricated areas			
7. Trim edges			
8. Part cleaning			
9. Foreign Particles removed			
10. Acceptable for shipping			
11. Packing			
12. Loading			

Mold Number: ________________ Part Number: ________________

Operator: ______________________________

Date: ______________________ (Prepped; Gel-coated; Laminated)

Inspector's Comments:

Instructor's Comments:

UNIT XI - WOODWORKING

This unit consists of classroom and laboratory activities designed to give the student a basic knowledge of woodworking materials and methods and the safe operation of woodworking equipment.

Tasks Covered:

1. Learn background information about hand tools.
    a. Open-book Woodworking Quiz #1
2. Learn background information about working with wood.
    a. Open-book Woodworking Quiz #2
3. Learn background information about fasteners and adhesives.
    a. Open-book Woodworking Quiz #3
4. Operate a power drill.
5. Operate a portable power saw.
6. Operate a saber saw.
7. Operate a router.
8. Operate a power sander.
9. Operate a power grinder.
10. Operate a sanding machine.
11. Operate a bench saw.
12. Operate a radial arm saw.
13. Operate a band saw.
14. Operate a drill press.

DUTY: WOODWORKING

TASK: Learn background information about hand tools.

Performance Objectives:

Given a lecture presentation and a reading assignment, the student will demonstrate a knowledge of background information on hand tools.

Evaluation Criterion:

The student will complete the Open-book Woodworking Quiz #1 with 100% accuracy.

Performance Guide:

1. Take notes on lecture presentation.
2. Complete the reading assignment: Reader's Digest Do It Yourself Manual, pp. 14-17, 21-27, 34-47, 42.
3. Complete the Open-book Woodworking Quiz #1.

FIBERGLASS: Open-book Woodworking Quiz #1

Name:________________________________ Date:__________________

1. The ____________________ hammer is used for general carpentry and nail-pulling. Its striking surface is ______________.

2. The ____________________ hammer is used for metal work and never for nailing.

3. The ____________________ saw is used for cutting across the grain.

4. A saw with a lower point number will cut (faster or slower) and leave a (smoother or rougher) surface.

5. The "kerf" is the slot left by the saw blade. It should be placed entirely on the __________ side of the cut-off line.

6. The ___________________ saw is designed to cut parallel to the grain.

7. The ___________________ is designed for joint-cutting work.

8. The ___________________ is used to copy an angle and transfer it to another area.

9. The ___________________ is used to make a line parallel to the edge of a board.

10. Drill from both sides to prevent ________________________.

11. The jaws of the woodworker's vice are lined with _________.

12. ___________________ clamps may be used when the high-clamping pressure is not required.

13. Use inexpensive _______________ to hand-sand heavily painted or pitchy surfaces.

14. Clean wood may be hand-sanded with _______________________.

15. ___________________ paper is fast and long-lasting for power sanding of wood or fiberglass.

16. ___________________ paper contains the hardest abrasive.

DUTY: WOODWORKING

TASK: Learn background information about working with wood.

Performance Objectives:

Given a lecture presentation and a reading assignment, the student will demonstrate a knowledge of background information about working with wood.

Evaluation Criterion:

The student will complete the Open-book Woodworking Quiz #2 with 100% accuracy.

Performance Guide:

1. Take notes on lecture presentation.
2. Complete the reading assignment: Reader's Digest Do It Yourself Manual, pp. 370-376, 382-386, 392-397.
3. Complete the Open-book Woodworking Quiz #2.

FIBERGLASS: Open-book Woodworking Quiz #2

Name:______________________________ Date:_________________

1. The actual dimensions of lumber are ________ than the nominal size by which it is sold.

2. A nominal 1" X 6" is actually ______ X ______.

3. A nominal 2" X 4" is actually ______ X ______.

4. No. ____ grade lumber contains tight knots, few blemishes and is suitable for a natural knotty finish or paint.

5. No. ____ grade lumber has loose knots and knot holes. It is suitable for shelfing, sheathing and fencing.

6. No. ____ grade lumber is the lowest board grade.

7. One board foot is equivalent to the amount of wood in a board, _____ foot long, _____ inch thick, and _____ inches wide.

8. Board foot is calculated according to (nominal or actual) size.

9. _____________ is the only dimension considered when calculating running foot.

10. Grade _____ plywood is smooth and paintable.

11. Grade _____ plywood allows knot holes and splits of limited size.

12. The group number used on plywood indicates the species of the tree used and the relative strength. It ranges from Group ____, the strongest, down to Group ____.

13. Exterior plywood is manufactured with _____________ glue.

14. Interior plywood is manufactured with _____________ glue.

15. When cutting plywood on a circular saw or a radial arm saw, always face the good side (up or down).

16. When cutting plywood with a portable power saw, the good side should face (up or down).

17. Hardboard is manufactured from ____________ which is forced into sheets under heat and pressure.

18. __________________ is the distance around a circle.

FIBERGLASS: Open-book Woodworking Quiz #2 - page 2

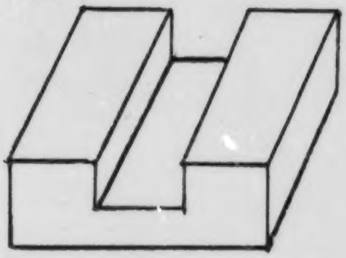
19. ______________ is the distance across a circle through its center.

20. ______________ is the distance from the center of the circle to its surface.

21. Match the following cut-names with the proper drawings:

( ) Dado cut
( ) Beveled cross cut
( ) Straight rip cut
( ) Rabbet cut
( ) Mitered cross cut
( ) Straight cross cut
( ) Beveled rip cut

(D)



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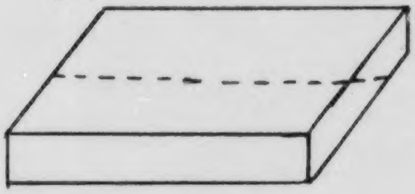

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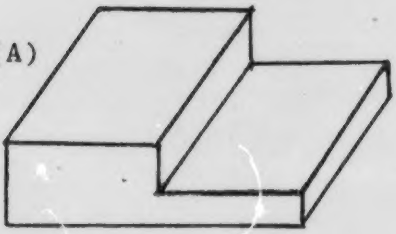

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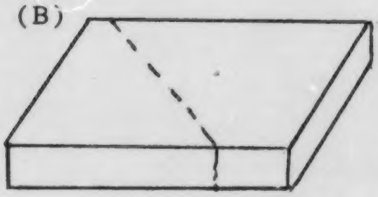

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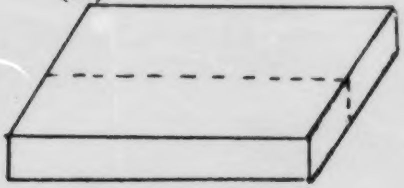

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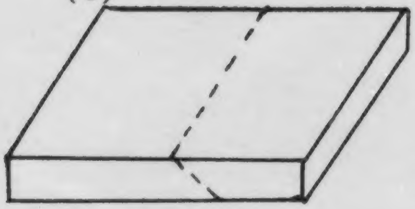

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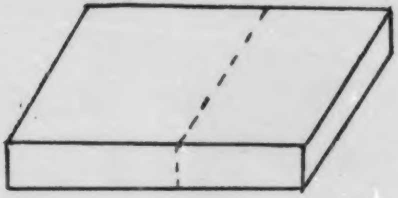

DUTY: WOODWORKING

TASK: Learn background information about fasteners and adhesives.

Performance Objectives:

Given a lecture presentation and a reading assignment, the student will demonstrate a knowledge of background information about fasteners and adhesives.

Evaluation Criterion:

The student will complete the Open-book Woodworking Quiz #3 with 100% accuracy.

Performance Guide:

1. Take notes on lecture presentation.
2. Complete the reading assignment: Reader's Digest Do It Yourself Manual, pp. 68-70, 72-75, 86.
3. Complete the Open-book Woodworking Quiz #3.

FIBERGLASS: Open-book Woodworking Quiz #3

Name:________________________________ Date:____________________

1. Nails should be driven through the ____________ piece of wood into the ________________ one.

2. The nail should be ___________ times as long as the thickness of the thin piece through which it passes.

3. Splitting can be avoided by _______________ the nail point.

4. Screw diameter is designated by __________ number, ranging from 0 (______ inch) through 24 (______ inch).

5. Select screw length so that at least ________ of the screw length is in the base material.

6. To enable screws to go into the work, a __________________ must first be drilled.

7. When two pieces of wood are joined with a screw, the _______________________ in the wood, through which the screw first passes, should pass the screw without binding.

8. The thread size of bolts is designated by the ___________ per inch.

9. Wood should be ____________________ before joining with ________________________.

10. When bonding nonporous materials with adhesive, first wipe the surface with ____________________________________.

DUTY: WOODWORKING

TASK: Operate a power drill.

Performance Objectives:

Given a reading assignment, a demonstration, a power drill, a bit and a board, the student will drill a hole.

Evaluation Criterion:

The student will install a bit and drill a hole. The hole will be straight and even and will be drilled with one even motion.

Performance Guide:

1. Complete the reading assignment: Reader's Digest Do It Yourself Manual, pp. 44-47.
2. Observe the demonstration.
3. Disconnect the power.
4. Install the bit.
5. Connect the power.
6. Drill the hole.
7. Disconnect the power.
8. Remove the bit.

DUTY: WOODWORKING

TASK: Operate a portable power saw.

Performance Objectives:

Given a reading assignment, a demonstration, a portable power saw, goggles, a square and a board, the student will make a cross-cut.

Evaluation Criterion:

Wearing goggles, the student will mark a square line across the board, adjust the blade depth so that one full tooth extends through the work piece, and perform a cross cut with one even motion. The cut will be smooth and straight. The student will not leave the saw until the blade has stopped.

Performance Guide:

1. Complete the reading assignment: Reader's Digest Do It Yourself Manual, pp. 48-51.
2. Observe the demonstration.
3. Disconnect the power.
4. Mark a square line across the board.
5. Adjust the blade depth so that one full tooth extends through the work piece.
6. Connect the power.
7. Perform the cut.
8. Disconnect the power.

DUTY: WOODWORKING

TASK: Operate a saber saw.

Performance Objectives:

Given a reading assignment, a demonstration, a saber saw, blade, goggles and a board marked with a curved line, the student will make a cut along the line.

Evaluation Criterion:

Wearing goggles, the student will install the blade and make a cut along the marked line with one even motion. The cut will be smooth.

Performance Guide:

1. Complete the reading assignment: Reader's Digest Do It Yourself Manual, p. 52.
2. Observe the demonstration.
3. Disconnect the power.
4. Install the blade.
5. Connect the power.
6. Perform the cut.
7. Disconnect the power.
8. Remove the blade.

DUTY: WOODWORKING

TASK: Operate a router.

Performance Objectives:

Given a reading assignment, a demonstration, a router, goggles, a bit and a board, the student will make a cut.

Evaluation Criterion:

Wearing goggles, the student will install the bit, set the depth to the instructor's specifications, and make a cut. The cut will be smooth and will not contain any turns.

Performance Guide:

1. Complete the reading assignment: Reader's Digest Do It Yourself Manual, pp. 54-55.
2. Observe the demonstration.
3. Disconnect the power.
4. Install the bit.
5. Adjust the depth to the instructor's specifications.
6. Connect the power.
7. Make the cut.
8. Disconnect the power.
9. Remove the bit.

DUTY: WOODWORKING

TASK: Operate a power sander.

Performance Objectives:

Given a reading assignment, a demonstration, a power sander, sandpaper, goggles and a board, the student will produce a smooth surface on the board.

Evaluation Criterion:

Wearing goggles, the student will install the sandpaper and sand the board. The surface of the sanded board will be smooth and even.

Performance Guide:

1. Complete the reading assignment: Reader's Digest Do It Yourself Manual, p. 57.
2. Observe the demonstration.
3. Disconnect the power.
4. Install the sandpaper.
5. Connect the power.
6. Sand the board.
7. Disconnect the power.

DUTY: WOODWORKING

TASK: Operate a power grinder.

Performance Objectives:

Given a reading assignment, a demonstration, a power grinder, goggles, water and a dulled chisel, the student will sharpen the chisel.

Evaluation Criterion:

Wearing goggles, the student will sharpen the chisel, dipping in water frequently. The sharpened edge will be smooth and even and will not be discolored. The student will not leave the grinder until the wheel has stopped completely.

Performance Guide:

1. Complete the reading assignment: Reader's Digest Do It Yourself Manual, p. 58.
2. Observe the demonstration.
3. Connect the power.
4. Sharpen the chisel.
5. Disconnect the power.

DUTY: WOODWORKING

TASK: Operate a sanding machine.

Performance Objectives:

Given a reading assignment, a demonstration, a sanding machine, goggles, a radius gauge and a board, the student will form a radius on the board.

Evaluation Criterion:

Wearing goggles, the student will adjust the alignment of the sanding belt and form a radius of specified size on the board. The radius will be smooth and straight and will conform to the size specified by the instructor. The student will not leave the sanding machine until the belt has stopped.

Performance Guide:

1. Complete the reading assignment: Reader's Digest Do It Yourself Manual, p. 59.
2. Observe the demonstration.
3. Connect the power
4. Align the belt.
5. Form the radius, checking frequently with the gauge.
6. Disconnect the power.

DUTY: WOODWORKING

TASK: Operate a bench saw.

Performance Objectives:

Given a reading assignment, a demonstration, a bench saw, goggles, a board and a push-stick, the student will perform a rip-cut.

Evaluation Criterion:

Wearing goggles, the student will set the blade height to 1/4" above the work piece, adjust the fence to the instructor's specifications, and perform a rip-cut. Feed pressure will be applied with the push-stick between the blade and the fence. The cut will be smooth and will be performed with one even motion. The student will not leave the saw until the blade has stopped.

Performance Guide:

1. Complete the reading assignment: Reader's Digest Do It Yourself Manual, p. 60.
2. Observe the demonstration.
3. Disconnect the power.
4. Set the blade height 1/4" above the work piece.
5. Adjust the fence to the instructor's specifications.
6. Connect the power.
7. Perform the cut.
8. Disconnect the power.

DUTY: WOODWORKING

TASK: Operate a radial arm saw.

Performance Objectives:

Given a reading assignment, a demonstration, a radial arm saw, goggles and a board, the student will perform a mitered cross-cut.

Evaluation Criterion:

Wearing goggles, the student will set the miter adjustment to the instructor's specifications, adjust the blade height to just below the table surface, and perform a mitered cross-cut. The cut will be smooth and will be performed with one even motion. The student will not leave the saw until the blade has stopped.

Performance Guide:

1. Complete the reading assignment: Reader's Digest Do It Yourself Manual, p. 61
2. Observe the demonstration.
3. Disconnect the power.
4. Set the miter adjustment to the instructor's specifications.
5. Adjust the blade height to just below the table surface.
6. Connect the power.
7. Perform the cut.
8. Disconnect the power.

DUTY: WOODWORKING

TASK: Operate a band saw.

Performance Objectives:

Given a reading assignment, a demonstration, a band saw, goggles and a board marked with a curved line, the student will make a cut along the line.

Evaluation Criterion:

Wearing goggles, the student will adjust the upper guide and make a cut along the marked line. The cut will be smooth and will be performed with one even motion. The student will not leave the saw until the blade has stopped.

Performance Guide:

1. Complete the reading assignment: Reader's Digest Do It Yourself Manual, p. 63.
2. Observe the demonstration.
3. Disconnect the power.
4. Adjust the upper guide to within 1/2" of the work piece.
5. Connect the power.
6. Perform the cut.
7. Disconnect the power.

DUTY: WOODWORKING

TASK: Operate a drill press.

Performance Objectives:

Given a reading assignment, a demonstration, a drill press, a bit and a board, the student will drill a hole of specified depth.

Evaluation Criterion:

The student will drill a hole to a depth of 3/4". The hole will be smooth and the operation will be performed with one even motion.

Performance Guide:

1. Complete the reading assignment: Reader's Digest Do It Yourself Manual, p. 66.
2. Observe the demonstration.
3. Disconnect the power.
4. Install the bit.
5. Adjust the depth stop to 3/4" below the surface of the stock.
6. Connect the power.
7. Drill the hole.
8. Disconnect the power.
9. Remove the bit.

FIBERGLASS:

UNIT XII - INDUSTRIAL RELATIONS

This unit consists of classroom activities designed to give the student an overview of the responsibilities and interrelationships of management, supervision and labor, job applications and job interviews.

Tasks Covered:

1. Learn about management, supervision and labor.
2. Learn how to complete job applications.
3. Learn what to do at job interviews.
    a. Questions Often Asked in Job Interviews.

DUTY: UNDERSTANDING INDUSTRIAL RELATIONS

TASK: Learn about management, supervision and labor.

Performance Objectives:

Given a lecture presentation and a question-answer period, the student will participate in a discussion about responsibilities and interrelationships of management, supervision and labor.

Evaluation Criterion:

The student will listen to the lecture presentation and will participate in the discussion.

Performance Guide:

1. Take notes on lecture presentation.
2. Participate in discussion.

DUTY: UNDERSTANDING INDUSTRIAL RELATIONS

TASK: Learn how to complete job applications.

Performance Objectives:

Given a lecture presentation on how to apply for a job and the necessary materials and information, the student will complete a standard job application form.

Evaluation Criterion:

The student will complete the job application form accurately and neatly.

Performance Guide:

1. Take notes on the lecture presentation.
2. Study the handout materials.
3. Complete the standard job application form.

DUTY: UNDERSTANDING INDUSTRIAL RELATIONS

TASK: Learn what to do at job interviews.

Performance Objectives:

Given a lecture presentation on the "DO's" and "DON'Ts" and handout reading materials, the student will participate in a mock interview.

Evaluation Criterion:

The student will be neat in appearance for the mock interview.

Given a list of questions often asked in job interviews, the student will answer concisely, in his own words, to the satisfaction of the instructor.

Performance Guide:

1. Take notes on the lecture presentation.
2. Study the handout materials. Become familiar with the list of questions.
3. Know proper behavior in an office setting with a waiting room and receptionist.
4. Participate in a mock interview as an interviewee first, then as an interviewer.

FIBERGLASS: Questions Often Asked In Job Interviews

Name: ______________________ Date: ______________

1. Tell me a little bit about yourself.....Training, etc.
2. Your family?
3. Were you in the military?
4. In what type of position are you interested?
5. Are you looking for permanent or temporary work?
6. How long do you expect to work?
7. How about overtime work?
8. What jobs have you held?
9. How did you get the job?
10. Why did you leave?
11. Can you get recommendations from previous employers?

FIBERGLASS: Questions Often Asked in Job Interviews - page 2

12. Do you have any other references?

13. Why do you think you might like to work for our company?

14. Why do you think you would like this particular type of job?

15. What do you know about our company?

16. What interests you about our product or service?

17. What relevant training have you received?

18. What are your ideas on salary?

19. Can you forget your education and start from scratch?

20. What are your future vocational plans?

21. Do you plan to return to school?

22. How much money do you hope to earn at age 30? 35? 45?

23. What do you think determines a person's progress in a good company?

24. Do you prefer working with others or by yourself?

25. Is it an effort for you to be tolerant of persons with a background and interests different from your own?

26. What kind of boss do you prefer?

27. Can you take instructions without feeling upset?

28. What have you learned from some of the jobs you have held?

29. Do you like routine work?

30. What are your major weaknesses/strengths?

31. Define cooperation.

32. Are you eager to please?

33. What do you do to keep in good physical condition?

34. Have you any serious illness or injury?

35. Are you willing to go where the company sends you?

36. To what extreme do you use liquor?

37. What have you done that shows initiative and willingness to work?

Introduction and Outline:

English
Spanish
Laotian

CE029805

CAREER DEVELOPMENT CENTER
SCHOOL OF TECHNICAL CAREERS
SOUTHERN ILLINOIS UNIVERSITY
CARBONDALE, ILLINOIS

COMPETENCY-BASED VOCATIONAL/TECHNICAL CURRICULUM SERIES

INTRODUCTION TO FIBERGLASS TECHNICIAN

MASAKO T. SHIN, CURRICULUM SPECIALIST, STC, SIU-C

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E. HOLLIS MERRITT, ASST. DEAN
LARRY HEPBURN, CENTER DIRECTOR

June 1981

INTRODUCTION

Although the first synthetic material was developed in the mid-nineteenth century, plastics did not become a major engineering material until the early part of the 20th century. Celluloid, the first synthetic or plastic material, did not advance the molded-products industry, because it was not flexible and had limited application. In the 1850's, the Synthetic Molded Products Industry was limited to the production of checkers, combs, picture frames, display plaques, etc.

Today, what we most often call Engineering Plastics includes the acetals, nylons, phenolics, polycarbonates, and fluorocarbons. The growth of these 20th century plastics in industrial and commercial use surpasses most conventional materials such as metals, rubber, ceramics and paper. These 20th century plastics have superior design flexibility, strength-to-weight ratio, abrasion resistance, corrosion resistance, and dimensional stability. Their basic advantages are less cost for the manufacturer and better products for the consumer.

Hence, the Fiberglass Reinforced Plastics Industry, a member of the Engineering Plastics Family, has become one of the fastest growing manufacturing businesses in the nation. Many areas of industry are using fiberglass reinforced plastics (FRP) to promote new products, new designs, parts, and production methods. As a result, there is a rapidly growing demand for trained FRP production workers and technicians.

In response to that demand, the Career Development Center of the School of Technical Careers at Southern Illinois University in Carbondale has developed a comprehensive training program for fiberglass production workers and technicians. The training period for a fiberglass technician is thirty-two (32) weeks. However, the program has an open entry/open exit policy which allows the student to leave the program whenever he or she is "job-ready" and can find a job.

The Fiberglass Technician Program provides the student with an in-depth study of the use of fiberglass reinforced plastic (FRP) and its components to create a finished product. The Fiberglass Curriculum covers the following modules: Orientation, Safety, Introduction to FRP, Hand Lay-up, Introduction to Equipment Operation, Chopper Operation, Gel-coat Operation, Finish and Repair, Mold-Making, Quality Control, Woodworking, Industrial Relations and Related Education.

The Fiberglass Training Program and the Career Development Center Staff will provide the student and the industry with appropriate help in placement and follow-up study. The industrial areas which are possible job markets for our graduates are: automotive, agricultural, chemical processing, construction, marine, recreational, transportation and electrical.

FIBERGLASS: DUTY-TASK INDEX

I. ORIENTATION TO FIBERGLASS

1. Demonstrate a full understanding of the attendance policy, C.D.C. rules and regulations, the curriculum outline and evaluation.

II. SAFETY

1. Maintain good safety and health habits.

III. LEARN BASIC INFORMATION ABOUT FIBERGLASS REINFORCED PLASTICS, FRP

1. Demonstrate an understanding of background information about FRP materials.
2. Demonstrate an understanding of the background chemistry of polyester resins.
3. Demonstrate an understanding of reinforcements and additives used in FRP.
4. Demonstrate an understanding of FRP molding methods.

IV. HAND LAY-UP

1. Identify and explain the use of lamination tools and materials.
2. Prepare a mold.
3. Laminate the mold.

V. EQUIPMENT OPERATION

1. Understand systems safety requirements.
2. Understand the operating principles of plural component systems.

VI. CHOPPER OPERATION

1. Learn the operating procedures for the airless chopper equipment.
2. Operate the airless chopper equipment.
3. Learn the operating procedures for the air-atomized chopper equipment.
4. Operate the air-atomized chopper equipment.
5. Calibrate the chopper equipment.

FIBERGLASS: DUTY TASK INDEX

VI. CHOPPER OPERATION (cont.)

6. Demonstrate production-level chopper operation competency.
7. Perform tool room duty.

VII. OPERATING THE GEL-COAT EQUIPMENT

1. Perform the airless gel-coat operation.
2. Perform the air atomized gel-coat operation.
3. Perform the equipment calibration.
4. Operate the gel-coat equipment at production level competency.
5. Serve as a tool room attendant.

VIII. FINISH & REPAIR

1. Identify repair materials and explain their use.
2. Identify repair tools and explain their use.
3. Restore the gloss.
4. Sand the gel-coat to remove surface imperfections.
5. Repair gel-coat defects which do not enter the laminate.
6. Repair a small hole which enteres but does not penetrate through the laminate.
7. Repair fractures or holes which penetrate through the laminate.
8. Respray a small area with gel-coat.

IX. MOLD-MAKING

1. Understand the mold-making process.
2. Sand to produce a level surface.
3. Build a mold from an existing plug.
4. Perform the Mirro-Glaze process.

X. QUALITY CONTROL

1. Identify and explain the testing equipment of the incoming materials.
2. Perform the in-process and final inspection.

XI. WOODWORKING

1. Learn background information about hand tools.
2. Learn background information about working with wood.
3. Learn background information about fasteners and adhesives.

XI. WOODWORKING (cont.)

4. Operate a power drill.
5. Operate a portable power saw.
6. Operate a saber saw.
7. Operate a router.
8. Operate a power sander.
9. Operate a power grinder.
10. Operate a sanding machine.
11. Operate a bench saw.
12. Operate a radial arm saw.
13. Operate a band saw.
14. Operate a drill press.

XII. UNDERSTANDING INDUSTRIAL RELATIONS

1. Learn about management, supervision and labor.
2. Learn how to complete job applications.
3. Learn what to do at job interviews.

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SPANISH VERSION

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TRANSLATED BY

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INTRODUCCIÓN

Aunque las primeras substancias sintéticas fueron producidas a mediados del siglo XIX, los plásticos no llegaron a ser un material de utilización técnica hasta principios del siglo actual. El celuloide, el primer material sintético, no fomentó la industria de productos moldeados porque no era moldeable y sí de aplicaciones limitadas. En la década de los cincuenta del siglo XIX la industria se limitaba a los peines, los marcos para cuadros o pinturas, pancartas de publicidad, etcétera.

Hoy día, los plásticos industrializables e industrializados incluyen los acetílicos, los nailones, los fenólicos, los policarbonatos, y los fluorocarburos. La tasa de crecimiento del empleo de los plásticos en la industria y el comercio supera la de la mayor parte de los materiales convencionales, tales como los metales, el hule (caucho o goma), la cerámica, y el papel. Esto se debe a la flexibilidad superior en diseño, a su peso leve, a su resistencia superior en proporción a su peso, a su resistencia a la abrasión, a la conservación de energía en su elaboración, a su resistencia a la corrosión, a su alta resistencia dieléctrica, y a su estabilidad dimensional. Las ventajas básicas todas suman a mejor rendimiento en costos para el fabricante y productos mejores para el consumidor.

La industria multifacética de la fibra de vidrio en conjunto con ciertos plásticos (las resinas poliestéricas) ha llegado a ser una de las industrias manufactureras de más rápido crecimiento de la nación. Muchos sectores industriales están empleando la fibra de vidrio para promover nuevos desenvolvimientos, la flexibilidad de diseño, la consolidación de piezas y métodos de producción. Por consecuencia hay una demanda siempre en aumento por los técnicos altamente adiestrados en el manejo de la fibra de vidrio y las resinas poliestéricas (los plásticos reforzados con fibra de vidrio).

En contestación a la demanda, la Escuela de Carreras Técnicas de la Universidad del Sur de Illinois en Carbondale (SIU-C) ha preparado un programa comprensivo en el adiestramiento de los técnicos en plásticos reforzados con fibra de vidrio. El período máximo de adiestramiento es de 32 semanas. El programa funciona de acuerdo con el concepto de inscripción y salida siempre abiertas, que permite al alumno dejar oportunamente sus estudios para aceptar un empleo no subvencionado.

El Programa en la Técnica de Fibra de Plásticos Reforzados con Fibra de Vidrio proporciona al alumno un estudio de fondo en el empleo del plástico reforzado con fibra de vidrio (FRP) y sus componentes para crear un producto terminado. El Plan de Estudios en Plásticos Reforzados con Fibra de Vidrio incluye lo siguiente: Orientación (20 horas), Seguridad en el Empleo (10 horas), Introducción a los Plásticos Reforzados con Fibra de Vidrio (20 horas), Laminación a Mano (30 horas), Introducción al Uso del Equipo (10 horas), Operación de la Troceadora (Trozadora) (140 horas), Aplicación de la Capa de

Gela (Gela-Capa) (140 horas), Acabado y Compostura (40 horas), Elaboración de Moldes (20 horas), Control de Calidad (10 horas), Relaciones Industriales (10 horas), y Educación Afín (160 horas).

El Programa de Adiestramiento en Plásticos Reforzados con Fibra de Vidrio proporciona al alumno y a la industria con la ayuda idónea en colocación y estudio suplemental. Los sectores de la industria indicados como posibles lugares de empleo para nuestros graduados son la industria automotriz, la agrícola, la de procesos químicos de fabricación, la de construcción, la industria marina, los recreos, los transportes, y la industria eléctrica.

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FIBERGLASS: DUTY-TASK INDEX

PLÁSTICOS REFORZADOS CON FIBRA DE VIDRIO: ÍNDICE DE DEBERES Y TAREAS

I. ORIENTACIÓN EN PLÁSTICOS REFORZADOS CON FIBRA DE VIDRIO

1. Demostrar comprensión entera del reglamento de asistencia, el plan de estudios y de la evaluación.

II. SEGURIDAD

1. Mantener buenas costumbres de seguridad e higiene.

III. APRENDER LA INFORMACIÓN BÁSICA SOBRE PLÁSTICOS REFORZADOS CON FIBRA DE VIDRIO

1. Demostrar una comprensión de la información de fondo sobre los materiales plásticos reforzados con fibra de vidrio (PRV).
2. Demostrar una comprensión de la química de fondo de las resinas poliestéricas.
3. Demostrar la comprensión de los refuerzos y los aditivos empleados con los plásticos reforzados con fibra de vidrio (PRV).
4. Demostrar una comprensión de la metodología de moldeo de plásticos reforzados con fibra de vidrio (PRV).

IV. LAMINACIÓN A MANO

1. Identificar y explicar el uso de la herramienta y de los materiales empleados en la laminición.
2. Preparar el molde.
3. Laminar el molde.

V. OPERACIÓN DEL EQUIPO

1. Demostrar comprensión de los requisitos de seguridad en los sistemas de elaboración de los productos.
2. Demostrar comprensión de los principios de operación del sistema de componentes múltiples.

VI. OPERACIÓN DE LAS TROCEADORAS

1. Aprender los procedimientos de operación de las troceadoras sin aire.

FIBERGLASS: DUTY-TASK INDEX

PLÁSTICOS REFORZADOS CON FIBRA DE VIDRIO: ÍNDICE DE DEBERES Y TAREAS

VI. OPERACIÓN DE LAS TROCEADORAS (Continuación)

2. Operar las troceadoras.
3. Aprender los procedimientos de las troceadoras.
4. Operar las troceadoras.
5. Calibrar las troceadoras.
6. Demostrar su competencia en la operación de las troceadoras al nivel de la producción industrial.
7. Servir como encargado del depósito (de la bodega) de herramientas.

VII. OPERACIÓN DEL EQUIPO DE APLICACIÓN DE LA GELA-CAPA

1. Llevar a cabo la operación de aplicar la gela-capa sin aire.
2. Llevar a cabo la aplicación de la gela-capa.
3. Calibrar el equipo.
4. Operar el equipo de aplicación de la gela-capa al nivel de la producción industrial.
5. Servir como encargado del depósito de herramienta.

VIII. ACABADO Y COMPOSTURA

1. Identificar materiales de compostura y explicar su uso.
2. Identificar la herramienta para la compostura y explicar su uso.
3. Restaurar el satinado (lustre).
4. Lijar la gela-capa para quitar las imperfecciones desperfectos en la superficie (superficiales).
5. Componer defectos (desperfectos) en la gela-capa que no penetran al laminado.
6. Componer un pequeño agujero que entra pero no pasa al través del laminado.
7. Componer roturas o agujeros que pasan al través del laminado.
8. Volver a aplicar a una área limitada la gela-capa.

IX. ELABORACIÓN DE LOS MOLDES

1. Demostrar comprensión del procedimiento de elaboración de los moldes.
2. Lijar para producir una superficie pareja.
3. Construir un molde empleando un patrón existente.

IX. ELABORACIÓN DE LOS MOLDES (Continuación)

4. Llevar a cabo el proceso "Mirro-Glaze."

X. CONTROL DE CALIDAD

1. Identificar y explicar el equipo para comprobar las materias al recibirse (entrantes en la bodega).
2. Llevar a cabo la inspección en proceso y final.

XI. ELABARACIÓN DE LA MADERA

1. Aprender los conocimientos básicas de la herramienta para la elaboración manual de la madera.
2. Aprender los conocimientos básicos de la elaboración de la madera.
3. Aprender los fundamentas sobre los adhesivos y modos de unir la madera (clavos, tornillos, etcétera).
4. Operar un taladro mecánico.
5. Operar una sierra portátil.
6. Operar una sierra de vaivén.
7. Operar una máquina fresadora de molduras.
8. Operar una lijadora mecánica.
9. Operar una esmeriladora.
10. Operar una máquina lijadora.
11. Operar una sierra circular.
12. Operar una sierra de columpio.
13. Operar una sierra de cinta.
14. Operar una prensa taladradora.

XII. COMPRENSIÓN DE LA RELACIONES INDUSTRIALES

1. Aprender algo sobre la dirección (administración) de la industria y comercio, y de la supervisión de los trabajadores y operarios.
2. Aprender a completar una solicitud de empleo.
3. Aprender cómo conducirse en una entrevista para el trabajo (empleo).

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LARRY HEPBURN, CENTER DIRECTOR

ຄຳນຳ.

ເຖິງແມ່ນວ່າການເຮັດສານວັດຖຸຂຶ້ນມາໃໝ່ໄດ້ເກີດຂຶ້ນເປັນເວລາດົນແຕ່ທາງສັດຕະວັດທີ 19 ແຕ່ພລາສຕິກບໍ່ໄດ້ເປັນສານທີ່ໃຊ້ໃນທາງວິສວະກັມ ຈົນເຖິງຕອນຕົ້ນຂອງສັດຕະວັດທີ່ຜ່ານມາ. Celluloid (ວັດຖຸໃສຊະນິດນຶ່ງ) ເປັນວັດຖຸທີ່ສ້າງຂຶ້ນມາດ້ວຍທາງເຄມີຂັ້ນແຣກ ແຕ່ບໍ່ໄດ້ວິວັທນາການເປັນອຸດສະຫະກັມຊະນິດຫລີ່ຫລອມ ເນື່ອງຈາກໃຊ້ເຮັດຈາກພືດຍາດ ຈຶ່ງບໍ່ຄ່ອຍໄດ້ໃຊ້ຫລວງຫລາຍ ແລະ ຈຳກັດຢູ່ກັບການໃຊ້ເລັກໆນ້ອຍໆ. ໃນປີ 1950 ອຸສະຫະກັມກ່ຽວກັບພລາສຕິກ ຜລິດສິ່ງຂອງຈຳກັດຢູ່ບໍ່ຫລາຍ ເຊັ່ນ: ແຜ່ນບໍ່ເປັນຮູບຕາຕະລາງ, ຫວີ, ຂອບຮູບ, ຝາຍຊີ້ ແລະ ອື່ນໆ.

ປັດຈຸບັນນີ້ ສິ່ງທີ່ເຮົາກ່າວເຖິງຢູ່ເລື້ອຍໆ ກ່ຽວກັບວິສວະກັມທາງພລາສຕິກ ຈະຮວມໄປເຖິງ Acetals, Nylons, Phenolics, Polycarbonate ແລະ Fluorocarbons. ຄວາມຈະເຣີນຢ່າງວ່ອງໄວ ແລະໃຫຍ່ ຂອງການໃຊ້ພລາສຕິກໃນທາງການຄ້າ ແລະ ການອຸດສະຫະກັມ ໄດ້ຈະເຣີນຂຶ້ນເກີນກວ່າການໃຊ້ ເຫຼັກ, ທອງ, ເຄື່ອງທະເບື້ອງ ແລະ ແຈ້ງ. ເນື່ອງຈາກຄວາມມີປະສິດທິພາບຂອງການອອກແບບໄດ້ຫລາຍຢ່າງ, ນ້ຳໜັກ ແລະ ແຂງແຮງ ເມື່ອປຽບທຽບກັບນ້ຳໜັກຂອງຕົວເອງ ຄວາມສາມາດຕ້ານທານການຜຸ ຊ່ວຍປະຢັດເຊື້ອເພີງ ປ້ອງກັນການເປັນໝ້ຽງ. ເຮັດເປັນສົມຜົນຢ່າງດີຫລາຍ ແລະ

ມີການຕຽມຕົວໃນການຮັກສາຮູບຮ່າງຂອງຕົວເອງ. ການໄດ້ປຽບຂອງຄຸນສົມບັດຕ່າງໆ ເມື່ອຮວມກັນແລ້ວຈະເຮັດໃຫ້ເຫັນການປະຢັດເງິນໃຫ້ແກ່ໂຮງງານທີ່ຜລິດ ແລະ ເປັນຜລິດຕະພັນທີ່ດີມີຄຸນແກ່ປະຊາຊົນ.

ອຸດສາຫະກັມການຜລິດພລາສຕິກຫລາຍໆດ້ານ ໄດ້ກາຍເປັນກິຈການການຜລິດທີ່ຈະເຣີນເຕີບໂຕຢ່າງວ່ອງໄວທີ່ສຸດໃນປະເທດ. ອຸດສາຫະກັມຫລາຍດ້ານທີ່ກຳລັງໃຊ້ພລາສຕິກ (Fiberglass) ສຳລັບສົ່ງເສີມການປະດິດແບບໃໝ່; ການອອກແບບຫລາຍຢ່າງ, ການຜລິດຊິ້ນສ່ວນປະກອບຫລາຍຢ່າງ ແລະ ວິທີການຜລິດຕ່າງໆ. ດັ່ງນັ້ນຄວາມຕ້ອງການຊ່າງຊ່າງທີ່ມີຄວາມຮູ້ທາງພລາສຕິກ ຈຶ່ງມີເພີ້ມຂື້ນຢ່າງໄວ.

ໃນການທີ່ຈະຕອບຮັບກັບຄວາມຕ້ອງການທາງພລາສຕິກ. ສູນພັທນາວິຊາຊີບ (Career Development Center) ຂອງວິທະຍາລັຍອາຊີວະ (School of Technical Career ຂອງມະຫາວິທະຍາລັຍສຶກສາ Southern Illinois University) ທີ່ເມືອງ Carbondale ໄດ້ຈັດແຕ່ງຫລັກສູດຂອງການຝຶກຊ່າງກ່ຽວກັບວິຊາພລາສຕິກຢ່າງທົ່ວໄປ. ຫລັກສູດການຝຶກສອນເປັນເວລາຢ່າງຫລາຍ 32 ອາທິດ. ໂຄງການຫລັກສູດອັນນີ້ ຈະຮັບນັກຮຽນບໍ່ວ່າຈະມີການສຶກສາລະດັບໃດ ແລະ ເມື່ອນັກຮຽນມີຄວາມຮູ້ພ້ອມທີ່ຈະໄປເຮັດງານຫາລ້ຽງຕົນເອງໄດ້ ຈະອອກຈາກຫລັກສູດໄປໄດ້ເລີຍ ໂດຍບໍ່ຕ້ອງລໍຈົນຄົບ 16 ອາທິດກໍໄດ້.

ໂດຍການຫຼັກສູດຂອງຊ່າງພລາສຕິກ ຈະຊ່ວຍໃຫ້ນັກຮຽນມີຄວາມຮູ້ຢ່າງຫຼວງຫຼາຍ ກ່ຽວກັບການໃຊ້ພລາສຕິກ ປະສົມຊະນິດຕ່າງໆ ແລະ ສ່ວນປະສົມຂອງພລາສຕິກ ໃນການສ້າງຜລິດຜົນສຳເລັດຮູບ.

ຫຼັກສູດຂອງພລາສຕິກຈະ ລວມກັນເປັນສັນດັ່ງນີ້:

ການເລີ້ມຕົ້ນແນະນຳຕົວ (໒໐ ຊົ່ວໂມງ), ຄວາມປອດພັຍ (10 ຊົ່ວໂມງ), ການເລີ້ມຕົ້ນກ່ຽວກັບພລາສຕິກຊະນິດປະສົມ (F.R.P) (໒໐ ຊົ່ວໂມງ), ວິທີການໃຊ້ມືຄ່ອງໆ ເຮັດພລາສຕິກໃຫ້ໜາຂຶ້ນ (30 ຊົ່ວໂມງ), ການແນະນຳກ່ຽວກັບເຄື່ອງມືໃນການໃຊ້ງານ (10 ຊົ່ວໂມງ), ການຕັດເສັ້ນໃຍພລາສຕິກ (140 ຊົ່ວໂມງ), ການເຄືອບໃຫ້ໜາຂຶ້ນຂະນະທີ່ພລາສຕິກກຳລັງມີສະພາບເປັນວຸ້ນຢູ່ (140 ຊົ່ວໂມງ), ການການຕັດແຕ່ງ ແລະ ຕຽມຜລິດຜົນສຳເລັດຮູບ (40 ຊົ່ວໂມງ), ການເຮັດແມ່ພິມ (20 ຊົ່ວໂມງ), ການຄວບຄຸມຄຸນພາບ (10 ຊົ່ວໂມງ), ວຽກກ່ຽວກັບຊ່າງໄມ້ (30 ຊົ່ວໂມງ), ຄວາມກ່ຽວພັນຂອງອຸດສາຫະກັມ (10 ຊົ່ວໂມງ) ແລະ ການສຶກສາປະກອບອື່ນໆອີກ (160 ຊົ່ວໂມງ).

ໂດຍການຝຶກສອນພລາສຕິກ ແລະ ພັທນາອາຊີບຂອງເຈົ້າໜ້າທີ່ຈະຊ່ວຍນັກຮຽນ ແລະ ອຸດສາຫະກັມໃນການຊ່ວຍເຫຼືອໃນການຫາງານໃຫ້ ແລະ ມີໜ້າທີ່ສຶກສາເພີ່ມຂອງນັກຮຽນທີ່ຈົບອອກໄປແລ້ວ. (ອຸດສາຫະກັມຕ່າງໆ ທີ່ຄິດວ່າຈະເປັນແຫຼ່ງທີ່ຈະມີງານໃຫ້ນັກຮຽນເຮັດ ຄື: ອຸດສາຫະກັມການຜລິດຣົດຍົນ, ການກະເສດ, ຜລິດກັມເຄມີ, ການກໍ່ສ້າງ, ການສ້າງເຮືອ,

ການເຮັດເຄື່ອງພັກຜ່ອນ, ການຊົນກິ່ງ ແລະ ການໄໝ່ໝ້າ.

FIBERGLASS: DUTY-TASK INDEX

ສາຂາ: ວິຊາ ໜ້າທີ່ ແລະ ການງານ ຂອງ ພລາສຕິກ.

I. ORIENTATION TO FIBERGLASS ການແນະນຳກ່ຽວກັບພລາສຕິກ.

1. ຈົ່ງສະແດງຄວາມເຂົ້າໃຈຢ່າງຫົວໜ່ວຍຂອງນະໂຍບາຍຂອງການຝຶກ ຮຽນ. ສ.ວ.ເປັນ ກົດ ແລະ ກໍຍັງຕັ້ງ, ຫຼັກສູດ ແລະ ການວັດ ຜົນ.

II. SAFETY ຄວາມປອດພັຍ.

1. ການສັງມີສ່ຽງ ແລະ ສຸຂພາບເບື້ອງຕົ້ນ.

III. LEARN THE BASIC INFORMATION IN FRP (FIBERGLASS REINFORCED PLASTICS)

ຮຽນຮູ້ກ່ຽວກັບຂໍ້ຄວາມທີ່ສຳຄັນໃນການເຮັດພລາສຕິກປະສົມ.

1. ສະແດງຄວາມເຂົ້າໃຈກ່ຽວກັບພື້ນຖານ (background information) ຄວາມຮູ້ກ່ຽວກັບວັດຖຸ F.R.P.
2. ສະແດງຄວາມເຂົ້າໃຈ ກ່ຽວກັບພື້ນຖານ ຂອງວິຊາເຄມີຂອງ ພລາສຕິກຢາງ.
3. ສະແດງຄວາມເຂົ້າໃຈ ກ່ຽວກັບສ່ວນໄຍປະສົມ ແລະ ເສັ້ນກຳລັງ ຂອງພລາສຕິກ (F.R.P.).
4. ສະແດງຄວາມເຂົ້າໃຈວິທີການ ຫຼໍ່ F.R.P.

IV. HAND LAY-UP ການໃຊ້ມືເຮັດໃຫ້ພລາສຕິກຈອມກັນເປັນຊັ້ນໆ.

1. ການໃຊ້ເຄື່ອງມືໃນການເຮັດພລາສຕິກຈອມກັນເປັນຊັ້ນ.
2. ກຽມແມ່ພິມ.
3. ເຄືອບແມ່ພິມ.

V. EQUIPMENT OPERATION ການດຳເນີນການຂອງເຄື່ອງ.

1. ສະແດງຄວາມເຂົ້າໃຈລະບົບຄວາມປອດໄພ
2. ສະແດງຄວາມເຂົ້າໃຈກ່ຽວກັບຂໍ້ຄວາມສຳຄັນຂອງການໃຊ້ເຄື່ອງມືຂອງລະບົບຫຼາຍລະບົບ.

VI. CHOPPER OPERATION ການໃຊ້ເຄື່ອງຕັດ

1. ຮຽນຮູ້ກ່ຽວກັບການໃຊ້ຂະບວນຂັ້ນໆ ຂອງເຄື່ອງມືຕັດຊະນິດບໍ່ຕ້ອງໃຊ້ລົມເປັນກຳລັງ.
2. ຄຸມເຄື່ອງຕັດຊະນິດໃຊ້ແຮງລົມດັນ.
3. ຮຽນຮູ້ກ່ຽວກັບການເຮັດວຽກເປັນຂັ້ນໆ ຂອງເຄື່ອງຕັດທີ່ໃຊ້ອາກາດ.
4. ໃຊ້ເຄື່ອງຕັດຊະນິດທີ່ໃຊ້ອາກາດ.
5. ຂະບ່ຽງແຍກຂະເປັນໜ່ວຍຂອງເຄື່ອງຕັດ.
6. ສະແດງຄວາມສາມາດຂ້ວະປະລິດຂອງເຄື່ອງຕັດ
7. ສະແດງຄວາມຮູ້ກ່ຽວກັບໜ້າທີ່ຂອງໜ້ຽງເຮັດວຽກ.

VII. OPERATING THE GEL-COAT EQUIPMENT ການໃຊ້ເຄື່ອງມືເຄືອບພລາສຕິກທີ່ລ້ຽງອ່ອນ.

1. ສະແດງການເຄືອບໂດຍບໍ່ຕ້ອງໃຊ້ຫົວສີດ.
2. ສະແດງການເຄືອບພະລະສຕິກ ໂດຍໃຊ້ອາກາດແຊະຊົມກັບພລາສຕິກສີດ.
3. ຂະບ່ຽງແຍກໃຫ້ເປັນໜ່ວຍຂອງເຄື່ອງມື.
4. ສະແດງຄວາມສາມາດຂັ້ນແປະຜິດຂອງເຄື່ອງເຄືອບພລາສຕິກ.
5. ເຮັດວຽກໃນໜ້ອງເຄື່ອງມື.

VIII. FINISH & REPAIR ຂັ້ນສຳເລັດຮູບ ແລະ ສ້ອມແປງ.

1. ຮູ້ແຈ້ງວັດຖຸສຳລັບສ້ອມແຊມ ແລະ ອະທິບາຍການນຳໃຊ້
2. ຮູ້ແຈ້ງເຄື່ອງມືສ້ອມແຊມ ແລະ ອະທິບາຍການນຳໃຊ້.
3. ຂັດໃຫ້ເຮືອໜ້າເປັນມັນ.
4. ຂັດດ້ວຍກະດາດຊາຍ ບ່ອນເຮືອໝ້າທີ່ບໍ່ດີ.
5. ສ້ອມແຊມບ່ອນທີ່ປີ້ເສຍ.
6. ສ້ອມແຊມບ່ອນທີ່ເປັນຮູ.
7. ສ້ອມແຊມຮອຍແຕກຫັກ ທີ່ ຮູ ທີ່ລອດ.
8. ສ້ອມບ່ອນນ້ອຍໆ ຜິດ ດ້ວຍ Gel-Coat.

IX. MOLD-MAKING ການເຮັດແມ່ພິມ.

1. ເຂົ້າໃຈວິທີເຮັດແມ່ພິມ
2. ຂັດດ້ວຍເຈ້ຍກະດາດຊາຍໃຫ້ລຽບ.
3. ເຮັດແມ່ພິມຈາກພື້ນພິມ.
4. ສະແດງວິທີເຮັດ Mirro-Glaze.

X. QUALITY CONTROL ການຄວບຄຸມຄຸນພາບ

1. ຮູ້ແຈ້ງແລະອະທິບາຍ ເຄື່ອງທົດສອບຂອງວັດຖຸດິບ.
2. ສະແດງການທົດລອງ ແລະ ການກວດກາຂັ້ນສຸດທ້າຍ.

XI. WOODWORKING ວຽກຊ່າງທັບຊ່າງໄມ້.

1. ຮຽນຮູ້ຊ່າງທັບພື້ນຖານ ຄວາມຮູ້ຂອງເຄື່ອງມື.
2. ຮຽນຮູ້ຊ່າງທັບພື້ນຖານ ຄວາມຮູ້ຂອງການຊ່າງໄມ້.

XI. WOODWORKING (cont.)

3. ຮຽນຮູ້ກ່ຽວກັບພື້ນຖານຄວາມຮູ້ຂອງຂອງອັນເຮັດໃຫ້ວັດຖຸເກາະຕິດກັນແໜ້ນ.
4. ໃຊ້ເຄື່ອງມືເຈາະ
5. ແຄມເຄື່ອງມືໃຊ້ເລື່ອຍ.
6. ໃຊ້ເລື່ອຍເສັ້ນໃຫ້ຕັ້ງສາກ
7. ໃຊ້ເຄື່ອງຈັກເຫຼັກຈະມິດຕິດເຈີ.
8. ໃຊ້ເຄື່ອງຂັດກູດ້ວຍໄຟຟ້າ.
9. ໃຊ້ເຄື່ອງຂັດຕະຄາດວາຍ.
10. ໃຊ້ເລື່ອຍຈະມິດຕິດກັບໂຕ໊ະ.
11. ໃຊ້ເຄື່ອງຝົນດ້ວຍໄຟຟ້າ.
12. ໃຊ້ເລື່ອຍເຈີໜ້າໂຕ໊ະ.
13. ໃຊ້ເລື່ອຍມືຈະມິດລາມັນ.
14. ໃຊ້ສະຫວ່ານຈະມິດຕັ້ງຕິດກັບໂຕ໊ະ.

XII. UNDERSTANDING INDUSTRIAL RELATIONS ການເຮັດໃຫ້ເຂົ້າໃຈ ກ່ຽວກັບຄວາມສຳພັນຂອງອຸດສະຫະກັມ.

1. ຮຽນກ່ຽວກັບການຄວບຄຸມໃນໂຮງງານ, ຜູ້ດູແລວຽກ ແລະ ກຸ່ມຊ່າງ.
2. ຮຽນການວາງກອບ ຫຼື ລະບຽບປະຕິບັດງານ.
3. ຮຽນການມີປະສຳພັນ.

Technical Lexicon:

English
English/Spanish
English/Laotian

CE 029 805

FIBERGLASS TECHNICIAN TECHNICAL TERMS

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FIBERGLASS TECHNICIAN TECHNICAL TERMS

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June 1981

FIBERGLASS: Technical Terms

accelerator: a promoter.

acetone: a cleaning solvent used for the removal of uncured resin from tools and clothing. CAUTION: Extremely flammable.

additive: a substance added to the resin mix to impart special performance qualities.

air-inhibited resin: a resin whose surface cure will be inhibited by the presence of air.

Barcol hardness tester: used to determine the relative hardness of a cured resin or gel-coat. This is measured by the material's resistance to puncture by a steel point.

bi-directional: an arrangement of the reinforcing fiber strands in which half the strands are laid at right angles to the other half.

Binder: bonding resin applied to fibers to hold fibers in position in a mat structure.

BPO: benzoyl peroxide; a highly corrosive paste-type catalyst.

bridging: a lamination defect caused by glass fibers rising up out of sharp corners.

cab-o-sil: a fumed silica used as a filler to make putty for repair work.

catalyst: a substance added to the resin to make it cure.

chopped strand: continuous strand glass yarn cut into uniform length of 1/8" to 2".

complementary shape: the opposite shape obtained by molding against the surface.

cure: plymerization; the transformation of the resin from a liquid to a solid state.

cure time: the time required for a liquid resin to reach a hardened state after the catalyst has been added.

delamination: the separation of a laminate into layers due to a failure of the adhesion.

FIBERGLASS: Technical Terms

exothermic heat: chemically generated heat developed by the action of the catalyst and promoter to cure the resin.

female shape: a finished inside surface; complement of a male shape.

fiberglass: glass drawn out to a sufficiently small diameter to be flexible; used as a reinforcement.

FRP: Fiberglass Reinforced Plastics

fillers: any material added to the resin to extend the volume and lower the cost.

foreign materials tester: used to determine the amount of solid particles in a resin or gel-coat as measured by straining.

glass master: a FRP plug built with mold building materials and techniques; used in high-production situations when more than one mold will be needed.

gel: a partial cure of the resin; a semi-solid, jelly-like state.

gel-coat: a filled, pigmented resin used as a surface coat.

gel-time: the amount of time between the addition of the catalyst and the formation of a gel.

gel-time meter: used to determine the "pot-life" of resin or gel-coat at any specified catalyst percentage. This is measured as the amount of time a glass rod can turn freely in the material.

inhibitor: a substance added to the resin to prevent premature cure.

lamination: the laying-on of reinforcing materials and resin by hand or using spray equipment.

lay-up: the process of lamination done by hand using reinforcing mat.

male shape: a finished outside surface; complement of a female shape.

mat: a randomly distributed felt of glass fibers.

MEKP: methyl ethyl ketone peroxide; a corrosive liquid catalyst.

FIBERGLASS: Technical Terms

mil: one one-thousandth (1/1000) of an inch; .001.

milled fibers: glass fibers cut 1/8" long or short.

mold: n. the form used to shape fiberglass parts. Its shape is the complement of the finished part.
v. to shape fiberglass parts on a form.

monomer: a coreactant thinner (styrene) used in resin.

multi-directional: an arrangement of the reinforcing strands in which strands are laid randomly in every direction.

plug: a structure used to form a mold. Its shape is identical to the finished part; a mock-up.

pot-life: gel-time; the amount of time that a catalyzed resin will remain workable.

prep: to prepare a mold for gel-coating and/or lamination.

promoter: a substance added to the resin which reacts with the catalyst to reduce the cure time.

prototype: a (scale) model constructed for the purpose of evaluation of design and performance.

PVA: polyvinyl alcohol, used as a film-type release agent.

reinforcement: a strong, inert material bound into the resin to improve its strength, stiffness, and impact resistance, usually fibrous in form.

release agent: waxes or films applied to a mold to aid in separation of the mold and the part.

resin: a liquid plastic which can be hardened by the action of a catalyst, used to surround and hold reinforcing fibers.

roll-out: the process of compacting glass fibers and removing air bubbles with a serrated roller.

roving: a collection of continuous glass filaments used to produce chopped strand.

shelf-life: the length of time an uncatalyzed resin will remain workable in a sealed container at room temperature.

FIBERGLASS: Technical Terms

sizing: a surface treatment given to glass fibers to allow resin to adhere to them.

spray-up: a lamination process using spray equipment which simultaneously deposits chopped strands and catalyzed resin into a mold.

styrene: see "monomer".

surfacing agent: wax solution; an oily substance, when added to the resin, which rises to the surface during cure and permits surface cure of air-inhibited resins.

tamping: the process of compacting glass fibers and removing air bubbles by stippling with a brush.

thermoplastic: a type of plastic which will repeatedly soften when heated and harden when cooled.

thermoset: a type of plastic which undergoes an irreversible chemical reaction during cure.

thixotropic agent: a substance added to the resin which gives it a variable viscosity: high when at rest, low when agitated.

tool: any structure used for forming a FRP; a mold or plug.

trim-time: the time between gel and cure when the laminate can be cut with a knife.

uni-directional: an arrangement of the reinforcing fiber strands in which all the strands lie in the same direction.

viscometer: used to determine the viscosity and thixotropic index of resin or gel-coat. This is measured by the material's resistance to a turning spindle.

viscosity: a measure of the flow properties or thickness of a liquid.

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ENGLISH-SPANISH LEXICON

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FIBERGLASS TECHNICIAN TECHNICAL TERMS

ENGLISH-SPANISH LEXICON

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FIBERGLASS: Technical Terms

PLÁSTICOS REFORZADOS CON FIBRA DE VIDRIO: Terminología Técnica

accelerator - acelerante: substancia que promueve el endurecimiento de la resina

acetone - acetona: solvente empleado para limpiar la herramienta y la ropa de la resina no coagulada. PRECAUCION: Extramadamente flamable!

additive - aditivo: una de varias substancias que se agregan a la resina para darle calidades especiales

air-inhibited resin: resina cuya polimerización superficial será inhibida por presencia del aire

Barcol hardness tester: probador de la dureza de la resina

bi-directional - bidireccional: colocación de las hebras de tal modo que la mitad se quedan a ángulo recto a las otras

binder - ligador: resina ligante aplicada a las fibras para mantenerlas en posición en una estructura enmallada

peróxido benzoico (BPO): un catalizador altamente corrosiva envasado en forma de una pasta

bridging: un defecto en la laminación que resulta en la formación de cavidades abovedadas donde las fibras se levantan en los rincones angulares

cab-o-sil: silica ahumada que se emplea como carga en la elaboración de mastique para trabajos de compostura

catalyst - catalizador: substancia que aumenta o inicia la polimerización de la resina

chopped strand: hebras o mechas troceadas

complementary shape: forma complementaria (se obtiene moldeando contra la superficie).

cure - polimerización: el curado de una resina durante el que la resina se transforma del estado líquido al sólido

cure time: tiempo de curado o polimerización

delamination - delaminación: la separacion de un laminado en capas debido a la falta de buena adhesión

FIBERGLASS: Technical Terms

PLÁSTICOS REFORZADOS CON FIBRA DE VIDRIO: Terminología Técnica

exothermic heat - calor exotérmico: el calor generado químicamente por el catalizador y el aumentador en la polimerización (curado).

female shape - forma hembra: forma complementaria a la forma macho

fiberglass - fibra de vidrio: el vidrio estirado hasta formar una fibra muy flexible, empleado como refuerzo de la resina polimerizada

fillers - cargas: cualquier substancia que se agrega al plástico para aumentar su volumen y disminuir el costo

foreign materials tester: probadora de materias extrañas mediante la deformación

glass master: una maqueta, patrón, o tarugo construido con la utilización de la técnica en plásticos reforzados con fibra de vidrio. Se emplean tales maquetas en las situaciones de alta producción donde se necesita más de un patrón

gel - gela (resina coloide coagulada): la polimerización parcial de la resina, semi-sólida y semejante a una jalea

gel-coat: capa pigmentada de gela

gel-time: tiempo de formación de la gela

inhibitor - retardador: substancia agregada a la resina para prevenir la polimerización prematura

lamination - laminación: la colocación de materias reforzantes y la resina a mano o con pistola de aire en varias capas

lay-up: laminación a mano

male shape - forma macho: una superficie o forma complementaria a la forma hembra

mat: afelpado (de fibras de vidrio).

MEKP - peróxido de metilco-etílico ketona: un catalizador corrosivo en forma líquida

FIBERGLASS: Technical Terms

PLÁSTICOS REFORZADOS CON FIBRA DE VIDRIO: Terminología Técnica

mil - la milésima parte de una pulgada: .001 pulgada

milled fibers: fibras de vidrio trituradas y de 1/8 de pulgada de largo

mold - molde: s. una forma usada para dar forma a objetos de fibra de vidrio. Tiene la forma complementaria a la parte que se elabora. Moldear: v. dar forma a partes de fibra de vidrio sobre una matríz.

monomer - monomero: un tíner (estirena) correaccionante que se emplea en la resina

multi-directional - polidireccional: colocación de las hebras de fibra de vidrio sin orden ni concierto

plug - patrón, tarugo, taco: una estructura empleada para formar un molde. Su forma es idéntica a la parte al acabarse de elaborar; una maqueta, o molde

pot-life - tiempo de formación de la gela: el tiempo que una resina mezclada con el catalizador seguirá trabajable

prep: prepara un molde para que se revista de gela

promoter: sustancia que aumenta la actividad de un catalizador (aumentador).

prototype: prototipo, o maqueta

PVA: alcohol polivinílico, empleado como agente que facilita extraer del molde un objeto elaborado

reinforcement - refuerzo: una materia fuerte e inerte en la resina para dejarla más fuerte y resistente. Generalmente una fibra

release agent: agente que facilita la extracción del molde la trabajada

resin - resina: un plástico en forma líquida que se endurece mediante la acción de un catalizador. Se usa para retener la fibra.

roll-out: el procedimiento de compactar las fibras de vidrio en la resina y de exprimir las burbujas de aire con una enrolladora dentada

FIBERGLASS: Technical Terms

PLÁSTICOS REFORZADOS CON FIBRA DE VIDRIO: Terminología Técnica

roving: mechas de fibra de vidrio que se emplean en la producción de mechas o hebras troceadas

shelf-life: el período de tiempo durante el cual permanecerá trabajable una resina sin catalizar dentro de un bote cerrado a la temperatura normal de habitaciones (15.5°C.).

sizing - apresto: tratamiento que se da a las fibras de vidrio para que se les adhiera la resina

spray-up: laminación con pistola de aire para que se depositen en el molde simultáneamente la resina catalizada y fibras troceadas

styrene - ver: monómero (estirena)

surfacing agent - una solución de cera: una substancia aceitosa, la que, al agregarse a la resina, sube a la superficie durante la polimerización y permite que se endurezca sin inhibirla el aire

tamping - afirmado: el procedimiento de compactación de fibras y resina para expeler las burbujas de aire picando con una brocha

thermoplastic - termoplástico: plástico que se ablandará repetidamente al calentarse y se endurecerá al enfriarse

thermoset - material termoendurecible: (plástico que esperimenta un cambio químico durante el proceso de moldear , y que se endurece sin que se pueda ser luego ablandado

thixotropic agent - agente tixotrópico: substancia que añadida a una resina le imparta una viscosidad variable, alta en el descanso y baja al agitarse

tool - patrón: cualquier estructura empleada para dar forma al plástico reforzado con fibra de vidrio. Por eso, herramienta, molde, o patrón

trim-time: el tiempo entre la mezcla de la gela y su polimerización cuando se puede cortar con una navaja o cuchillo

uni-directional - unidireccional: el arreglo de las fibras de vidrio de tal modo que todas se extiendan en la misma dirección

FIBERGLASS: Technical Terms

PLÁSTICOS REFORZADOS CON FIBRA DE VIDRIO: Terminología Técnica

viscometer: viscosímetro

viscosity: viscosidad

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FIBERGLASS: Technical Terms ໄຟເບີກະລາສ (ພລາສຕິກ) ພາສາເທັກນິກ.

accelerator: ຕົວເຮັດໃຫ້ (ໄຟເບີກະລາສ) Fiberglass.

acetone: ແອຊີໂຕນ. ນ້ຳຢາ ທຳລາຍລ້າງສ່ວນປະສົມຕັ້ງ (Resin) ຂອງໄຟເບີ ກລາສ ຣະວັງເກີດໄຟໄດ້.

additive: ສ່ວນປະສົມເພີ້ມຕື່ມ ສຳລັບເຮັດໃຫ້ໄຟເບີ ກລາສ ມີຄຸນນະພາບດີຂຶ້ນ.

air-inhibited resin: ສ່ວນປະສົມພລາສຕິກ ເຮັດໃຫ້ ເປັນໄຟເບີ ກລາສ ໂດຍປົກປິດໄວ້ ບໍ່ໃຫ້ຖືກກັບອາກາດ.

Barcol hardness tester: ເຄື່ອງວັດຄວາມແຂງຂອງພລາສຕິກ.

bi-directional: ການຈັດເສັ້ນພລາສຕິກເປັນເສັ້ນໆ ໂດຍສານະເປັນຕາຕະແລງ.

Binder: ສ່ວນປະສົມພລາສຕິກ ທີ່ເຮັດໃຫ້ກາກແລະແຜ່ນຂອງພລາສຕິກ ຕິດກັນແໜ້ນເປັນແຜ່ນ.

BPO: ເບັນໂຊອີ ເປີຣອກໄຊ ນ້ຳຢາຕົວແຂງ ຈະມີດແຫຼວ ເໝືອນກາວ.

bridging: ການຕິດ (ຍຶດ) ແໜ້ນທີ່ບໍ່ສົມບູນ ເຮັດໃຫ້ຂອບຂອງແຜ່ນພລາສຕິກ ບໍ່ລຽບ.

cab-o-sil: ແກ້ວບົດເປັນເມັດນ້ອຍໆ ໃຊ້ເຮັດເປັນແປ້ງແໜວ ສຳລັບແຕ່ງ ແຜ່ນພລາສຕິກ.

catalyst: ນ້ຳຢາຕົວແຂງ ເຮັດໃຫ້ພລາສຕິກ ເຮັດໃຫ້ ເຣຊິນ (Resin) ເປັນພລາສຕິກແຂງ.

chopped strand: ເສັ້ນເໝືອນຝ້າຍ ໄດ້ເປັນນ້ອຍໆ ຕັດເປັນຄວາມຍາວ 1/8 ນິ້ວ ເຖິງ 2 ນິ້ວ.

complementary shape: ຮູບແບບທີ່ຢູ່ກົງກັນຂ້າມກັບແມ່ພິມ.

cure: ການປ່ຽນສະພາບຂອງສ່ວນປະສົມພລາສຕິກ ຈາກຂອງແຫຼວເປັນຂອງແຂງ.

cure time: ຣະຍະເວລາທີ່ຕ້ອງການໃນການເຮັດໃຫ້ພລາສຕິກຈະມີດແຫຼວ ປ່ຽນຕົວເປັນພລາສຕິກແຂງ ໂດຍການໃຊ້ນ້ຳຢາຊ່ວຍ.

delamination: ການແຍກຕົວອອກຈາກກັນຂອງແຜ່ນທີ່ຕິດກັນເປັນຊັ້ນ.

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exothermic heat: ຄວາມຮ້ອນ ເກີດຈາກຕົວຊ່ວຍ ໃນການປະສົມ ເຮັດພລາສຕິກ

female shape: ດ້ານໃນ (ຮຽກຮູບ ສ່ວນຕົວເມັຽ).

fiberglass: ເສັ້ນພລາສຕິກ ເສັ້ນນ້ອຍໆ ອ່ອນນຸ້ມໆ ໃຊ້ສຳລັບປະສົມພລາສຕິກ ເຮັດໃຫ້ແຂງແຮງ.

fillers. ສ່ວນປະສົມຢ່າງອື່ນ ທີ່ເພີ່ມຕື່ມໃນພລາສຕິກ ເຮັດໃຫ້ຈຳນວນຫລາຍຂື້ນ ແລະໃຫ້ຣາຄາຖືກລົງ.

foreign materials tester: ເຄື່ອງວັດ ວ່າມີ ສ່ວນປະສົມພລາສຕິກ ຫລາຍເທົ່າໃດ.

glass master: ອັນຫຼໍ່ແມ່ພິມ ໃຊ້ສຳລັບເຮັດແມ່ພິມຫລາຍໆອັນ.

gel: ສ່ວນປະສົມພລາສຕິກ ທີ່ກຳລັງອ່ອນຢູ່ ເໝືອນວຸ້ນ

gel-coat: ສ່ວນປະສົມຂອງພລາສຕິກ ທີ່ມີສີ ໃຊ້ສຳລັບເຄືອບຜິວໜ້າ ດ້ານຕ່າງໆ.

gel-time: ຣະຍະເວລາໃຊ້ຕົວຊ່ວຍ ກ່ອນທີ່ຈະເປັນເນື້ອອ່ອນເໝືອນວຸ້ນ.

inhibitor: ສ່ວນປະສົມທີ່ເຮັດໃຫ້ການເປັນພລາສຕິກຊ້າລົງ.

lamination: ການເຄືອບອ້ອມພລາສຕິກ.

lay-up: ການເພີ່ມຕື່ມຄວາມໜາຂອງພລາສຕິກ ໂດຍເອົາ ເປັນເສັ້ນ ເຮັດຈາກພລາສຕິກ ສຳລັບເສັ້ນໃຫ້ແຂງແຮງຂື້ນ.

male shape: ດ້ານຂ້າງນອກ (ຮູບສ່ວນຕົວຜູ້).

mat: ແຜ່ນໄຍເຍ້ (Fibers).

MEKP: ນ້ຳຢາຊ່ວຍ (ເປັນກົດ ເຮັດໃຫ້ກັດຂອງຢ່າງອື່ນ.

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mil: ຄວາມໜາ .001 ນິ້ວ.

milled fibers: ພລາສຕິກທີ່ຕັດເປັນແທ່ງໆ 1/8 ນິ້ວ ຍາວຫຼືສັ້ນກວ່າ.

mold: - ນາມ ແມ່ນ ແມ່ພິມ.
- ກິລິຍາ ແມ່ນ ພິມ.

monomer: ນ້ຳຢາ Styrene ໃຊ້ໃນສ່ວນ ປະສົມພລາສຕິກ (Resin).

multi-directional: ເສີມໃຫ້ພລາສຕິກແຂງແຮງ ໂດຍໃຊ້ເສັ້ນ (Fiber) ແຈກຢາຍໄປທົ່ວໆ.

plug: ຕົວເຮັດແມ່ພິມ.

pot-life: ເວລາທີ່ນ້ຳຢາຕົວຊ່ວຍທຳງານຢູ່.

prep: ກຽມແມ່ພິມກ່ອນຈະເລີ່ມ.

promoter: ນ້ຳຢາຊະນິດນຶ່ງຊ່ວຍນ້ຳຢາຊ່ວຍໃຫ້ເປັນພລາສຕິກແຂງແຮງຂຶ້ນ.

prototype: ແບບຕົວຢ່າງ.

PVA: ໂພລີໄວນອລ ແອລກໍຮອລ.

reinforcement: ການເສີມສ້າງໃຫ້ແຂງແຮງ, ກັນແຕກ - ແຫງແຕ່ນ.

release agent: ຕົວຢາ ສໍາລັບທາໃສ່ເທິງແມ່ພິມ ເພື່ອເຮັດໃຫ້ຄອດອອກມາໄດ້ງ່າຍ.

resin: ພລາສຕິກແຫຼວ ກ່ອນທີ່ຈະປະສົມກັບຕົວຊ່ວຍ ໃຊ້ສໍາລັບຍຶດເສັ້ນ Fibers ເພື່ອໃຫ້ເກາະແໜ້ນຕິດກັນຢ່າງໜາແໜ້ນ.

roll-out: ວິທີເຮັດຢ່າງນຶ່ງ ເພື່ອໄລ່ຟອງອາກາດອອກຈາກພລາສຕິກ.

roving: ສາຍ ຫຼື ແຖວ ຂອງພລາສຕິກ ທີ່ຕັດເປັນມັດໆ.

shelf-life: ຣະຍະເວລາເກັບພລາສຕິກ ວ່າຈະຍັງໃຊ້ໄດ້ດົນປານໃດ.

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sizing: ການຈຸ່ມດ້ານໜ້າຂອງພລາສຕິກເສັ້ນ ທໍາດ້ວຍແກ້ວ ກໍາລັງ ເພື່ອໃຫ້ ພລາສຕິກແຫຼວ ເພາະຫົດກັນ ກ່ອນທີ່ຈະແຂງຕົວ.

spray-up: ການທີ່ສັງ ພລາສຕິກ ໂດຍໃຊ້ເຄື່ອງຈັກ ແລະຜົສມກັນກັບພລາສຕິກ ເສັ້ນທໍາດ້ວຍແກ້ວ ສັງເປັນຜົດ ລົງໄປ ເພື່ອຈະໃຫ້ຮູບຮ່າງຈາກແມ່ພິມ.

styrene: ເຊິ່ງ " Monomer."

surfacing agent: ນໍ້າຢາປະສົມກັບໄຂມັນ ປະສົມກັບພລາສຕິກອ່ອນ ເຮັດໃຫ້ມັນລອຍຂຶ້ນມາຍັງອາກາດ.

tamping: ການໄລ່ຟອງອາກາດ ໂດຍໃຊ້ແປງມົນໆ ເຮັດໃຫ້ພລາສຕິກມີເນື້ອແໜ້ນ.

thermoplastic: ພລາສຕິກພວກນີ້ ເມື່ອຖືກຄວາມຮ້ອນ ຈະອ່ອນລົງ ແລະແຂງຕົວເມື່ອເຢັນລົງ.

thixotropic agent: ສານທີ່ເພີ່ມໃນ Rosin ທີ່ເຮັດໃຫ້ ຄວາມໜຽວຢູ່ແລ້ວ

tool: ເຄື່ອງມື ສໍາລັບ ເຮັດແມ່ພິມ, ພໍ່ພິມ.

trim-time: ຣະຍະເວລາທີ່ພລາສຕິກກໍາລັງແຂງຕົວ ໂດຍສາມາດເອົາໃບມີດຕັດໄດ້.

uni-directional: ການຈັດເສັ້ນ ເສັ້ນແຕ້ມພລາສຕິກ ກະຈາຍໄປຮອບໆ.

viscometer: ເຄື່ອງວັດຄວາມໜຽວ

viscosity: ໜ່ວຍວັດຄວາມໜຽວ. ຫຼື ຄວາມໜາ ຂອງຂອງເຫຼວ.